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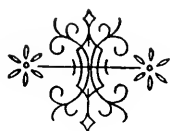
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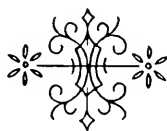
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Longevity

OF MANUFACTURING CONCERNS
IN ALLEGHENY COUNTY



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LONGEVITY OF MANUFACTURING CONCERNS
IN ALLEGHENY COUNTY

INTRODUCTION

This is a study of manufacturing concerns which have lived seventy-five years or more in Allegheny County. Its purpose has been to determine some reasons for their long life.¹ Thirty firms are emphasized which survived the period 1873–1947.

No known study has investigated the causes contributing to longevity of manufacturing concerns. This investigation, therefore, could not benefit from previous works of any similar nature.

The absence of similar studies has not entirely eliminated the use of previously determined data. Investigations concerning business mortality have been made and they, of course, do shed some light on the longevity of business. Numerous mortality studies have been made, with varying results, depending upon the type of business involved, the location of the study, the period investigated, the sources used, and the refinements of the methods employed. All these studies have arrived at the conclusion that mortality rates for business concerns are too high for a healthy economy.

Most mortality studies, however, have been limited to some phase of retail trade, thereby making their findings largely inapplicable to this investigation of manufacturing concerns. This may be because the life span of manufacturing concerns is complicated by the formal aspects of their organization and the strenuous efforts made for rehabilitation of insolvent concerns.² Or, it may be as McGarry states: "Few economic changes have been of more interest to marketing men than those centering around the life and death of independent retail stores."³

Studies concerning mortality of retail trade, however, provide unreliable data for measuring the mortality of manufacturing concerns. Consequently, such studies have been used in this investigation only to provide examples of established procedure.

There is, moreover, a shortage of mortality studies of manufacturing concerns. This is unfortunate. The problem of business failure is one of the important current economic problems. Mortality studies involving manufacturing firms might offer assistance in finding an acceptable solution.

¹ See Appendix V.

² Cover, John H., *et al.*, Temporary National Economic Committee, *Problems of Small Business, Monograph No. 17*, United States Government Printing Office, Washington, p. 45 (1941).

³ McGarry, Edmund D., *The Mortality of Independent Grocery Stores in Buffalo and Pittsburgh, 1919–1941*, *The Journal of Marketing*, p. 14, July (1947).

Among the few published studies on the mortality of manufacturers there is variation concerning the average length of life attributed to various manufacturing groups. In a study of mortality in Minneapolis, St. Paul, and Duluth, Minnesota, from 1926 to 1930,⁴ the average length of life of manufacturing concerns was found to be eight years. The average life of printing establishments was 62.6 years. The span of life of other divisions of manufacturing concerns upon discontinuance was from 2.6 years for music and radio, 4.9 years for clothing and textiles to 11.4 years for lumber manufacturers and 15.5 for woodworking establishments. Epstein found automobile manufacturers⁵ had an average life span of eight years from the date of their origin until 1924. For the automobile manufacturers⁶ existing in the period 1903 to 1926, the average longevity was 9.4 years. Davis disclosed an average life up to 1935 of 5.2 years for shoe manufacturing firms which had entered business since 1905 and were located in the states of Maine, Wisconsin, Missouri and Pennsylvania, and in the cities of Brockton, Lynn, Haverhill and Rochester.⁷

Although these studies provide an average age upon discontinuance for various manufacturing groups, they are not usable in this investigation.⁸ Their inadequacy results from three important factors: first, all of the studies were made in a region other than Allegheny County; secondly, of the studies which include estimates of longevity, only one covers a period exceeding seventy-five years,⁹ and the others concentrate upon recent turnover records. Finally, the methods of procedure and of analysis used fail to disclose the continued existence of a business having a continuity of ownership through changes in the name of the enterprise, in the form of organization, or in the location of the establishment.

After the major work of this study was completed, there was published in *The Smaller Manufacturer* an article "Do You Know the History of Your Firm?" written by Dr. John W. Oliver of the University of

⁴ Heilman, E. A., *Mortality of Business Firms in Minneapolis, St. Paul and Duluth, 1926-1930*, University of Minnesota Press, p. 7 (1933).

⁵ Epstein, Ralph C., *The Rise and Fall of Firms in the Automobile Industry*, Harvard Business Review 2, January (1927).

⁶ Epstein, Ralph C., *The Automobile Industry. Its Economic and Commercial Development*, McGraw-Hill, Inc. (1928).

⁷ Davis, Horace B., *Business Mortality: The Shoe Manufacturing Industry*, Harvard Business Review, Spring (1939).

⁸ See Appendix V for detailed description of techniques employed in this study.

⁹ Hutchinson, R. G. and A. R. Newcomer, Mabel, *Study in Business Mortality*, American Economic Review, September (1938).

Pittsburgh.¹⁰ It gave both greater significance to this work and satisfaction to the writer. In it Dr. Oliver stated that there is a gap in the study of our history. Students of American history study presidential campaigns, wars, and tariffs; but business, upon which so much of our life is built and around which it revolves, has only little time and space in our history classes and texts. Of course, Dr. Oliver is interested in history and this study deals with economics, but in the gathering of the material for this paper the gap he mentioned was a handicap. This study of longevity factors made it necessary to get historical data about manufacturers in this area. In a great many instances, the answers to important questions could not be obtained because adequate, historical information had not been recorded.

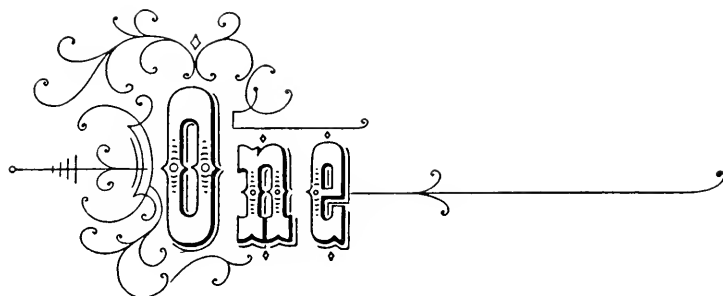
As Dr. Oliver says:

The need for histories of this type is imperative. They must not be a mere collection of glorified advertisements, showing the company's business. They must be something more than an elaborate booklet of illustrations. Any business that has been in existence for a hundred years, fifty years, or even twenty-five years has reasons to be proud of its history. Such an organization has contributed its share to the community in which it is located. It has become a definite part of the economic, social, and cultural life of that community. And there is something within that company's organization that accounts for its success.¹¹

This quotation becomes a statement of a need and a reason for more business research as a contribution to the understanding of a community's life.

¹⁰ Oliver, John W., "Do You Know the History of Your Firm?" *The Smaller Manufacturer*, Vol. 3, No. 10, p. 4 (1948).

¹¹ *Ibid.*



ECONOMIC BACKGROUND OF THE

ALLEGHENY COUNTY AREA

The fact that Pittsburgh is an industrial center of major importance is as much due to nature as it is to man, for its location at the confluence of the Allegheny and Monongahela rivers makes it advantageous both strategically and commercially. Early recognition of these advantages led to the early building of forts by the French and English and the growth of a settlement here; so that by the time settlers started moving westward Pittsburgh was ready to operate as a trading post and a manufacturing center.

As was true in all colonial settlements, the inhabitants of Pittsburgh were primarily farmers. The soil was favorable for the production of grains. But since transportation of the grain was difficult in this area, distilling became a prosperous business. In Allegheny and adjacent counties about a fifth of the farmers were distillers, producing more whiskey in proportion to population than any other part of the country.¹

When Congress levied an excise tax on spirits distilled from grain, the settlers here found the measure unjust and showed their resentment in the "Whiskey Rebellion." It was more than the feuding of "moonshiners" and revenueurs; it was an organized fight to protect the settlers' chief commodity of trade. Opposition to the law lasted until late in 1794 when President George Washington felt it necessary to journey to Pittsburgh to settle the matter. He did not, however, come beyond Bedford, for by that time the Whiskey Rebellion had ended with the signing of the test of submission. There followed an investigation in Philadelphia to which many were called but only two were convicted, and they were pardoned by the president.² Although the local forces had been defeated, the insurrection had brought so much publicity to the area that its popularity as a place of settlement grew tremendously, and laborers and craftsmen of various kinds began to migrate to Pittsburgh.

Instead of carrying all their supplies over the Alleghenies settlers were able to fill some of their needs such as nails, knives, and cloth from manufacturers here. The cash supplied by these settlers stimulated the growth of industry and led to the manufacture of less basic items. The westward movement emphasized the need for improved means of communication and transportation, and boat building became a major industry in western Pennsylvania.

¹ Killikelly, Sarah H., *History of Pittsburgh*, B. C. and Gordon Montgomery Company, Pittsburgh, p. 63 (1906).

² Dr. Thomas Cushing, A. A. Lambing, Russell Errett, R. H. Kelly, *et al.*, *History of Allegheny County, Pa.*, A. Warner & Co., Chicago, Ill. (1889).

Although there were some earlier industries such as stone cutting, brick making, and log sawing connected with the building of the forts and a small amount of manufacturing done mostly by families to take care of their own needs, boat building was the first of Pittsburgh's real industries. It began with the arrival of "fourteen carpenters and sawyers" from Philadelphia in 1777 to build thirty batteaux to be used for the transportation of troops.³ By 1794 the first mail boats were operating from Wheeling to Limetown, and their success led to the establishment of a passenger line to Cincinnati.

Because of strained relations between France and this country in 1797, Congress ordered two vessels to be built here—the "President Adams" and the "Senator Ross" designed for use on the lower Mississippi River. Subsequent to that, great numbers of boats of various types were constructed by Tarascon Brothers, James Berthoud and Company, established in 1800. The first vessels built by this company were a schooner and a ship, named the "Amity" and "Pittsburgh," respectively.

The first steamboat to operate on western waters was the "New Orleans," built in Pittsburgh in 1811 by Livingston, Fulton, and Roosevelt at a cost of about \$38,000. This was an event of utmost importance, for it did more than anything else to stimulate the development of industry in the west—especially coal mining. In addition, it was a demonstration of the practicability of steam navigation of the rivers, and numerous steamboats were constructed at a rapid rate in Pittsburgh and its vicinity. From 1811 to 1835, 226 steamboats were built in Pittsburgh, twenty-two at Brownsville and seven at Beaver.⁴

This expansion of the boat building industry was halted by the Panic of 1837, but it revived again with the building of iron steamboats and canal boats. The first of these was "The Valley Forge," built in 1839 by Robinson, Minis, and Miller. During the next year about one hundred iron boats were constructed here, resulting in added growth in the coal trade and other industries.

Boat building showed an almost constant rise to the peak year of 1857 when 141 boats were constructed here, and thereafter the industry started a downward trend, partly because of the development of railroads, until in 1888 only two vessels were built.

³ *History of Commerce, Pittsburgh and Environs*, A. F. Parsons Publishing Company, New York, p. 42 (1893-4).

⁴ Thurston, George H., *Pittsburgh As It Is*, W. S. Haven, Pittsburgh, pp. 69-73 (1857).

TRANSPORTATION

The westward movement demanded improved means of communication and transportation from the eastern coast to the headwaters of the Ohio. The building of the Erie Canal from the Hudson to Lake Erie was deflecting western trade through New York, and this brought about the realization that Pennsylvania needed quicker and cheaper transportation across this state. The Act of February 25, 1826, authorized the "commencement of the canal to be constructed at the expense of the state."⁵ The western section was completed and the first boat entered Pittsburgh, on November 10, 1829.

Additional acts provided for the construction of other parts, including the Portage Railroad over the mountains, and by April 16, 1834 a through line was in operation to the coast. This cut freight rates between Philadelphia and Pittsburgh about 66 $\frac{2}{3}$ per cent.⁶ It was the Pennsylvania Canal that lifted Pittsburgh out of the slough into which it had fallen during the years following the collapse of business after the War of 1812. The city had begun to recover from that recession, but new strength came into its commercial life with the improved means of transportation with the coast. The canal saw extensive use both for freight and passengers for twenty years, until it was superseded by the Pennsylvania Railroad.

No matter how extensive and well developed were Pittsburgh's waterways, the increase in manufacture and the westward movement made additional transportation, a railway system, necessary. The matter was given attention as early as 1827; when the Baltimore and Ohio Railroad was chartered by the Maryland legislature, the citizens chose a committee to seek the permission of the Pennsylvania legislature to have the road extended to Pittsburgh. Interest increased and many roads were projected, but nothing was accomplished until stock of the Pittsburgh and Connellsville and the Pennsylvania Central railroads were offered for sale in 1846. The former met with great success; the latter did not; this resulted in Pittsburgh's first railway fight which was not settled until 1848 when both lines began pushing westward.

In 1851 the Pittsburgh and Ohio Railroad opened its line to Beaver, when on the first of July the first locomotive, having been brought from the east on the canal, was set on the tracks. The same year saw the organization and the beginning of construction of two other railroads,

⁵ Wilson, Erasmus, *Standard History of Pittsburgh, Pennsylvania*, H. R. Connell & Company, Chicago (1898), p. 121.

⁶ *Ibid.*, p. 124.

the Pittsburgh and Cleveland and the Pittsburgh and Steubenville. In 1852 the Baltimore and Ohio and the Pennsylvania Central opened their routes to the east, and in the next year work was begun on the Allegheny Valley Railroad. The year 1854 brought the opening of the Pennsylvania Railroad for its entire length. In spite of financial difficulties and political machinations, the railroads expanded. This progress in transportation brought to Pittsburgh a business revival and gave promise of substantial prosperity.

By 1857 there were nearly a dozen railway lines reaching out in all directions from Pittsburgh and connecting it with the nation's other major cities. At this time the Pennsylvania Railroad began taking over control of transportation to the east and purchased the canal from the state for \$7,500,000.⁷

In the decade that followed came the most significant advance in the safety of railway transportation, the invention of the air brake by George Westinghouse. Westinghouse was a man of remarkable ability who brought to Pittsburgh a diversity of industry. He was issued the patent for the air brake in April, 1869, organized the Westinghouse Air Brake Company, and began manufacture in the same year.

Where there develops a concentration of capital and a large laboring class, each concerned with the furthering of its own interests, it is to be expected that there will be trouble between them. Although there had been strikes before, the first of the great outbreaks in the Pittsburgh area were the railroad riots of 1877, which were characterized by excessive violence and destruction of property in spite of the calling in of the state and national militia. It resulted in the payment of nearly \$3,000,000 in damages for claims made against Allegheny County. In addition to burning the round house, the Union Station, and various business houses, the rioters destroyed 1,383 freight cars, 104 locomotives, and 66 passenger coaches.⁸ The rioting demonstrated the need not only for some system of protection for Pittsburgh but also for some means of settlement of labor disputes.

By 1905, seven railroads were servicing the Pittsburgh district and two other lines handled freight on the tracks of the Pittsburgh and Lake Erie Railroad. The total tonnage shipped out of Pittsburgh by rail that year came to 92,000,000 tons, greater than the tonnages of New York, Chicago, and Boston combined. At the beginning of the twentieth century it was possible to handle up to 25,000 cars daily, and passenger traffic averaged 1,500,000 persons a month.⁹

⁷ *Ibid.*, p. 128.

⁸ Cushing, *et al.*, *op. cit.*, p. 663.

⁹ *Ibid.*, p. 257.

COAL AND COKE

Records exist that coal was used in Fort Duquesne and Fort Pitt and that the Penns issued grants for the mining of coal from the southside hills. Coal was first used in manufacturing in 1797 in the glass works of O'Hara and Craig. However, the development of coal mining as an industry and the exporting of coal are closely related to the advancement of methods of water transportation and especially the building of the steamboat.

Coal used as ballast was shipped to Philadelphia by way of New Orleans in the ship "Louisiana," in 1803, and in the next year, in the brig "Nanina." It was sold there at 37½ cents per bushel or \$10.50 a ton. The increased settlement of the area east and west, with the improvement of transportation, brought out the value of coal as a source of wealth and power. Allegheny, Westmoreland, and Fayette counties, having Pittsburgh at the center, contain the richest coal deposits in the United States and have the added advantage of being located on channels of transportation. In the 1800's there was access to over twelve thousand miles of navigable streams, and by 1900 over twenty thousand miles of inland waters were open to navigation from Pittsburgh.¹⁰

Pittsburgh's coal trade increased steadily from 1814, when Thomas Jones made the first shipments of coal down the Ohio, and it was accelerated with the towing of coal by steamboats. In 1845 Daniel Bushnell towed six thousand bushels to Cincinnati in three tows pushed by the "Walter Forward." His success brought about the widening of the Pittsburgh coal market. "French Creeks," flat-bottomed boats 80x20x6, were built in large numbers to carry cargoes of coal down stream. Companies were formed and new mines opened, until by the turn of the century the district was producing one-eighth of the nation's coal.

In addition to being abundant, coal had the added advantage, in the Connellsville region, of being particularly adapted to conversion into coke. The production of coke in commercial quantities dates from 1841 when two ovens were built on the farm of James Taylor a few miles below Connellsville. By the spring of the next year, sixteen hundred bushels had been manufactured and shipped for sale in Cincinnati. Two years later, in 1843, these ovens were rented to Mordecai, James, and Sample Cochran.

As coke replaced charcoal in the manufacture of iron, the coke industry expanded; and the high quality of Connellsville coke is chiefly

¹⁰ *Ibid.*, pp. 245-7.

responsible for the development of the pig iron industry west of the Alleghenies.

The blowing in of the Clinton furnace in Pittsburgh, in 1859, demonstrated that coke was most successful as a furnace fuel. The influence of the development of the Clinton furnace on the coke industry is illustrated by the increase in the number of ovens in the vicinity from four in 1850 to twenty-five in 1870. By 1880 this region was producing 72.16 per cent of the nation's coke.

GAS

To the fuels found in the Pittsburgh district must be added natural gas and oil. Both were discovered and put to use much later than coal and coke and to some extent replaced the coke. Natural gas was first applied to manufacturing in 1875 when Spang, Chalfant and Company and Graff, Bennet and Company piped it from wells in Butler County to mills in Etna, seventeen miles away. However, it was not until nearly a decade later that it was adopted generally as a fuel. In 1884 George Westinghouse organized the Philadelphia Company to supply natural gas to mills, factories, hotels, and homes. Just two years later the company had 336 miles of pipes serving over three thousand customers.¹¹ By 1903 the company's five hundred wells were supplying gas to 140,000 consumers.¹² This rapid conversion to gas fuel was "transforming Pittsburgh into the cleanest manufacturing city of the world."¹³

PETROLEUM

Although it was discovered earlier than natural gas, petroleum was not as readily accepted as a fuel and its development into an industry was slower. In fact, it was considered a nuisance when it was found in salt wells and efforts were made to shut it out. Its first use was as an ointment for medicinal purposes, and it was not until much later that its value as a fuel and lubricant was realized.

The earliest method of obtaining oil was to drain it off the surface of water, and it was not until 1859 that Colonel Drake conceived the idea of obtaining oil in quantity by sinking a well. This well, sunk in Venango

¹¹ Thurston, George H., *Pittsburgh's Progress Industries and Resources*, A. A. Anderson and Son, Pittsburgh, p. 13 (1886).

¹² Killikelly, *op. cit.*, p. 247.

¹³ Thurston, *Pittsburgh's Progress*, p. 13.

County, produced ten barrels of oil a day at first, and then when a pump was added, gave up forty. The news of pumping "black gold" from the ground caused a mania of buying up land and speculating in oil. This excitement over the discovery of large amounts of oil led to increased investment and speculation in other fields that brought about the establishment of a stock exchange in Pittsburgh in 1860.

The increased use of oil made necessary the erection of refineries here. Seven were built in 1860, and by 1867 fifty-eight were employing seven hundred persons. During the five years from 1863 to 1867, Pittsburgh's oil export business amounted to nearly \$47,000,000. Most of the oil was shipped eastward and went on to foreign parts, so that for the same period "Pittsburgh supplied over 60 per cent of the whole foreign exportation of petroleum."¹⁴ The shipping of oil having reached such a tremendous volume, an easier and more economical method of transportation seemed necessary.

The building of pipe lines changed the means of shipping petroleum and revised the operation of the oil trade. The brokers no longer handled barrels of crude oil; they exchanged pipe line certificates. This meant that the petroleum could be sold and re-sold without moving; it stayed in the tanks of the pipe line companies until the last exchange was made, and it was shipped on to the east for consumption there or for export.

At the same time the pipe lines were being built there was a decrease in the number of refineries because of the concentration of refining interests. This did not, however, mean a slackening of the oil trade. Between 1867 and 1876 there was a decrease of 50 per cent in the number of refineries in operation, but there was an increase of 200 per cent in refining capacity during the same period. By 1886 there were only twelve refineries in operation, but they employed nearly a thousand persons and had a capacity of 32,958 barrels of crude oil a day.¹⁵

GLASS

Of great importance to early settlers of Pittsburgh was the establishment of a glass works here. Window glass was essential for the building of homes, business houses, and boats, and there was a demand for hollow glass ware for domestic use, especially lamp chimneys. At first, glass was imported from the east and from Europe, but it was too expensive for most, especially since crude methods of transportation made carrying it over the mountains a hazardous business.

¹⁴ *Ibid.*, p. 191.

¹⁵ *Ibid.*, pp. 192-3.

Credit for establishing the first glass works west of the Alleghenies has been given to General James O'Hara and Major Isaac Craig; but in addition to that, they were the first in America to use coal as the fuel in glass manufacture. They began the manufacture of green glass in 1795 after persuading a glass worker, William Eichbaum, to leave the Schuylkill Glass Works near Philadelphia to supervise the erection and operation of the glass plant here. Before the first bottle was blown the venture represented an outlay of \$30,000. It was this tremendous amount of capital necessary that caused Major Craig's relatives to fear financial ruin, and after seven years he broke his partnership with O'Hara, who continued alone.¹⁶

In 1802, General O'Hara produced the first flint glass, and soon the original heavy investment made in the glass works began to be returned. In 1804 the output of these works in both flat and hollow glass ware amounted to \$12,500, and by 1807 the annual production had reached \$18,000.¹⁷

General O'Hara's success encouraged others to set up glass works, and by 1810 there were three operating here. In the seven years between 1810 and 1817 their annual production rose from \$46,000 to \$130,000.¹⁸

By the mid 1800's the value of glass produced during the year had reached nearly \$1,500,000 and in the twenty-five years to 1875 it more than doubled. It was during these twenty-five years that gas was substituted for coal as the fuel used in the production of glass and this brought about a marked improvement in the quality of the product.

IRON

From the very first the demand for iron products existed here and to the west, and the high cost of transporting them from the east brought early efforts to develop local resources to satisfy the need. The first blast furnace was built in 1792 in Shady Side on the site of the present Pennsylvania Railroad station by an Alsatian, George Anshutz. His venture, however, was marked for failure since he had mistaken the red shale in the area for iron ore. He found it necessary, therefore, to bring the ore from Roaring Creek on the Kiskiminetas River. The high cost of transportation and the burning of his wood supply during the Whiskey Rebellion caused him to abandon the furnace, and further development of the iron industry was discouraged.

¹⁶ *Ibid.*, p. 102.

¹⁷ Wilson, *op. cit.*, p. 198.

¹⁸ Thurston, *Pittsburgh's Progress*, p. 102.

In 1803 Joseph McClurg, Joseph Smith, and John Gormly established the first iron foundry in Pittsburgh, but the pig iron had to be brought in from other centers of manufacture. Casting cannon, howitzers, shells, and balls, this foundry became famous during the War of 1812 since it was one of the sources of supply for Commodore Perry's fleet in Lake Erie and for General Jackson's army at New Orleans.

The earlier failure in iron manufacture was forgotten, and the growth of the industry was rapid. In 1813 three foundries were operating in Pittsburgh, and in 1817 the first rolling mill to produce bar iron in this country was established in Fayette County. In 1811 there had been an attempt in Pittsburgh by Christopher Conner to produce bar iron. His mill was without a puddling furnace, however, and his venture failed. In 1819 the first mill to roll bar iron was established in Pittsburgh; it had four puddling furnaces. Iron soon became the major industry here, and by 1831 there were twelve foundries employing 132 men and having an annual production of over \$2,000,000. In twenty-five years the number of foundries and machine shops grew to thirty-two, with 1,597 hands and an annual production valued at over \$3,000,000. The two twenty year periods marked off by 1836, 1856, and 1876 showed the same rate of increase in mill and foundry products, that ratio of increase being 115 per cent.

The increasing success in the manufacture of iron products had brought a renewed attempt in the manufacture of pig iron here. In 1859 Graff, Bennet and Company erected the Clinton furnace in the South Side of Pittsburgh. This demonstration of the successful production of pig iron here encouraged the establishment of other furnaces. Although the growth of the iron industry had been rapid, it was not until 1874, when the Bessemer process of producing steel was introduced at the Edgar Thomson works of the Carnegie interests in Braddock, that the real boom in Pittsburgh's iron industry occurred.

STEEL

The second half of the century saw the establishment of a number of iron and steel companies, some of which were to become the largest in the world. Jones, Lauth and Company, established in 1853, later became Jones and Laughlin Steel Company, the largest independent steel company in the world. The Jones and Laughlin American Iron and Steel Works were the first to use iron ore from the Lake Superior region in the Eliza furnace, the third in Allegheny County, in 1860. At the turn

of the century, Jones and Laughlin was chartered as a corporation with a capital of \$30,000,000. By that time, it owned iron properties in the Lake Superior region, extensive limestone and coal deposits, and it manufactured its own coke for its own furnaces.

In any account of the progress of the iron and steel industry the name of Andrew Carnegie rises above all others. Because of his establishing numerous concerns and introducing new processes of manufacture, he became the Titan of the industry. He either organized or had an interest in nineteen iron and steel companies in the Pittsburgh district between 1864 and 1892, the first being the Cyclops Iron Company which furnished iron for bridges. By the turn of the century the Carnegie Steel Company had a capacity of nearly 3,500,000 tons of steel, about a third of the production in the United States; it owned nineteen blast furnaces, eight Bessemer converters, fifty-six open hearths, thirty-four rolling mills, an armor plate works, and a forge.

In the Pittsburgh district, in 1903, there were 43 blast furnaces, 15 Bessemer converters, and 117 open hearths, one of them being the Talbot type. The annual production in the area amounted to 4,211,569 tons of pig iron, 5,261,380 tons of iron and steel, and 712,300 tons of steel rails.¹⁹

INDUSTRIAL PROGRESS. 1792-1945

Pittsburgh's development as an industrial and commercial center meant that it would be influenced not only by local incidents, but by those of national and international consequence. The city's prosperity, or lack of it, has been directly related to tariffs and monetary measures, wars and recessions following wars.

As early as 1792, boasting a population of only six hundred, Pittsburgh had thirty-seven manufacturers of goods for others; among them were a watch maker, a breeches maker, a stocking weaver, a rope maker, coopers, tanners, cabinet makers, hatters, weavers, blacksmiths, shoemakers, tinnerns, wheelwrights, whitesmiths, saddlers, and a brewer.²⁰

From that time until after the Whiskey Rebellion development was slow. But, the notoriety gained during the insurrection put Pittsburgh "on the map" and brought attention to the fact that there was a thriving settlement here. In addition, many of the soldiers who had been ordered here stayed after the rebellion; others returned to the east to get

¹⁹ Killikelly, *op. cit.* pp. 249-50.

²⁰ Wilson, *op. cit.*, p. 198.

their families. Since the settlement was growing rapidly, its welfare demanded some sort of order in its government, so it took a step forward on April 22, 1794 with the incorporation of Pittsburgh as a borough.

From year to year new industries were established as the citizens set out to build up trade with the south and west and to make themselves as independent as possible of eastern and European manufactures. By 1808 Cramer's *Navigator* listed 174 manufacturing establishments in Pittsburgh. This development was considerably encouraged by the great volume of emigration to the west which was at its height during the first twenty years of the nineteenth century. Pittsburgh's location at the head of the Ohio River meant that most of the emigrants passed through here, and the tremendous effect on commerce and manufacture can be realized when it is pointed out that during the five years from 1810 to 1815, 365,489 persons came through to Kentucky, Ohio, and Indiana.²¹

Although the wisdom of the nation's plunging into the War of 1812 can be questioned, Pittsburgh found the conflict a boon. The call to Pittsburgh's factories to furnish military supplies was answered promptly. In the foundry of Joseph McClurg were produced the first cannon made under contract for the fleet on Lake Erie. Rigging and cordage for the fleet were also manufactured here. But, even more important than this stepping up of production of war materials was the shutting off of imports from Europe. Men of foresight set out immediately to supply the needs of the ever growing population here and to the west with goods manufactured on this side of the Alleghenies. Their success is illustrated in this statement by the Governor of Pennsylvania.

In proportion to the difficulty of access to, and commerce with, foreign nations, is the zeal and exertion to supply our wants by home manufactures. Our mills and furnaces are greatly multiplied. We make in Pennsylvania various articles of domestic use, for which, two years since we were wholly dependent upon foreign nations.²²

The signing of the Treaty of Ghent in 1815 was a blow to Pittsburgh's industry, for goods that had been overflowing European warehouses flooded into this country to compete with domestic manufactures. At that time two-thirds of the population of Pittsburgh was engaged in manufacture, so that the resulting recession was felt keenly. Concerned

²¹ Killikelly, *op. cit.*, p. 120.

²² *Ibid.*, p. 145.

about the future of Pittsburgh as a manufacturing center, the citizens held a meeting in December 1817 and appointed a committee to study the problem. The committee's report was far from optimistic. The nation's tariff policy was inadequate in spite of duties on textiles, hats, cabinet wares, leather, and paper. The manufacture of cottons, woolens, flint glass, and some articles of iron had fallen into a serious depression. Some industrial concerns that had been operating for many years had closed completely or worked on a very small scale, and others more recently established were never even put into operation.

To help themselves, the manufacturers in the area organized the Pittsburgh Manufacturing Association in 1819. They opened a warehouse on Wood Street where they handled various articles for sale, making no charge for the sale of those items manufactured by members of the association. After 1823 the association handled as much as \$60,000 worth of Pittsburgh manufactures annually in addition to goods shipped here for sale from the east. With advances in commercial methods, however, the usefulness of the organization declined and was replaced by others.

The attempt to get assistance from the national government for Pittsburgh's declining industries met opposition from the established interests of both the agricultural south and the mercantile east. The south found a ready market for its chief crops, tobacco and cotton, and had nothing to gain from any protective tariffs. The merchants of the east would find their profits cut by any restrictions on imports, for foreign goods sold at a lower cost than domestic manufactures and in many instances they were also of superior quality.

Pressure to save Pittsburgh's industries continued, however, and in October 1819, the community's citizens met in the courthouse to hear a memorial designed to be sent to Congress. It recited the difficulties encountered by manufacturers because of the government's low tariff policy and pleaded for the encouragement of domestic industry.

At the same meeting a committee was appointed to make a comparative study of the state of manufactures for the years 1815 to 1819. Their report verified the need for heavier duties. In 1815 there were 1,960 persons employed in Pittsburgh, and the total business amounted to \$2,617,833. By 1817 employment had fallen to 1,469 and business had dropped to \$2,225,464. In 1819 only 672 hands were employed and business had sunk to \$832,000. In the next two years the community experienced a general suspension of all business activity.

In spite of the lack of prosperity, Pittsburgh grew during the decade

from 1810 to 1820. The population in 1820 was 7,248, an increase of 5,320 or 73 per cent.²³

Emigration kept Pittsburgh alive during its first depression until, in 1824, the manufacturing interests succeeded in securing a strong tariff law. Business revived immediately, and in 1825 commercial transactions in Pittsburgh exceeded those of any previous year. This upward trend was further stimulated by the beginning of the construction of the Pennsylvania Canal in 1826. Most industries were prospering under the protection of the tariff of 1824; however, woolen manufacturers still suffered from competition with foreign goods. When they began to demand higher duties on wool imports, Pittsburgh and all of Pennsylvania offered enthusiastic support. The result of this pressure was "The Tariff of Abominations" in 1828, with extreme provisions for the protection of northern manufacturing interests. This measure was vigorously opposed by the southern states where the "Doctrine of Nullification" developed.

To placate the south Congress revised the tariff, in 1831, making it more moderate than that of 1828 but leaving it highly protective. The south was not satisfied, and the result was the "Ordinance of Nullification." The industries of Pittsburgh were adequately protected, however, and the prosperity of the community continued.

Tariff continued to be the big issue in Congress, and in 1832 Clay's compromise tariff was passed. It provided for a regular reduction of tariffs for ten years, at which time duties on all imports would be 20 per cent. But national unrest continued with Jackson's fight against the United States Bank until in 1832 he vetoed the bill rechartering the bank and ordered the Secretary of the Treasury to remove deposits. This precipitated the nation's business into a state of turmoil which reached its climax in the Panic of 1837.

Because of its geographical location and its decreasing dependence on the east, Pittsburgh fared better than other parts of the country during the depression. In 1830, the population of the city was 12,568 and by 1835 it had increased by 50 per cent.²⁴ Pittsburgh was fast becoming the most important manufacturing center in the nation. In 1835 the value of manufacturing and commercial business was estimated at \$15,000,000, and goods handled here were valued at \$50,000,000.

The growth of commerce and manufacture needed guidance for the best interests of the community, so, in 1837, the Board of Trade was

²³ Cushing, *et al.*, *op. cit.*, p. 621.

²⁴ *Ibid.*, p. 621.

organized and chartered. It proposed the "proper direction of all commercial movements, to encourage and extend the facilities of transportation and generally to take proper measures for the extension and regulation of the trade and commerce of this city."²⁵

Early in the 1840's there was no surplus in the national treasury, and faced with the need for increased revenue, Congress passed the tariff of 1842. It raised duties on most imports and brought about the revival of American manufacture. In Pittsburgh progress continued, and with the success of Daniel Bushnell's effort to tow coal by steam, in 1845, the local coal market widened.

When the United States entered the War with Mexico in the same year, Pittsburgh was recognized as an important center of industry, communication, and transportation. The mills and factories were again called upon to produce war materials, and the city served as a vital point in the movement of troops and supplies southward.

In 1845, Pittsburgh experienced a major calamity. On April 10 a fire swept through the business center which covered fifty-six acres. Destroyed were 982 buildings valued at \$1,500,000, and the loss in personal property came to \$2,400,000. Estimates of the total loss to the city ranged from \$5,000,000 to \$8,000,000.

In December 1846, telegraphic communication was opened with the east, and shortly the line was extended to Cincinnati and Louisville. This improvement in communication was of great benefit to Pittsburgh in the conduct of the war and especially in the execution of its business.

The state of affairs in Europe did much to promote local manufacture at this time. Ireland experienced its great famine in 1846, and the following years found crops short all over Europe; so in spite of the fact that the tariff of 1846 decreased protection to manufactures, most domestic trade had little difficulty with foreign competition.

The cotton mills, which had a later start than most of Pittsburgh's established industries, collapsed at this time, but only partly because of the tariff. There was difficulty in obtaining cotton from the south because of the impossibility of navigating the rivers during summer's drought and winter's ice jams. In addition, local operators could not afford the ten hour law that had been adopted by eastern manufacturers with whose products they were competing. With the difficulties in maintaining cotton mills increasing, the factory owners found it in their best interests to close, so that by the middle of the century, Pittsburgh's cotton trade had disappeared.

²⁵ Wilson, *op. cit.*, p. 170.

At the end of the decade business was given greater impetus with the European Revolution of 1848 and the discovery of gold in California. The sale of real estate boomed, and the city began to spread out over the hills. The cost of land increased from 18 to 35 per cent, depending upon the location.

In 1850 Pittsburgh proper had a population of 46,610 and the adjacent communities added nearly 22,000 more.²⁶ More than twelve thousand persons were employed by the city's major industrial concerns. At that time there were thirteen rolling mills, thirty large foundries, two manufacturers of malleable iron castings, five large cotton factories, eight flint glass plants, seven phial furnaces, eleven window glass manufacturers, a soda ash factory, a copper smelting works, and a copper rolling mill. There were also six white lead factories and numerous manufacturing concerns of small size. Capital invested in manufacturing amounted to more than \$10,000,000 with an annual production of an equal amount.²⁷

There had been during the late 1840's a general fear that the business world would experience another depression; this apprehension became a fact in the early 1850's. Among the causes of Pittsburgh's depression was its poor political management. The mayor, Joseph Barker, was both inefficient and eccentric. He had been arrested several times for disturbing the peace, for assault and battery, and for assault and battery with intent to kill. He seemed to have set the pattern for others, for the period was marked by lawlessness, especially incendiarism and robbery.

The gloom that had settled over Pittsburgh's industry was deepened by the city's bad credit. The bonded debt amounted to \$1,000,000, and the purchase of nearly \$2,000,000 in railroad bonds had been made. The system of collecting taxes was inadequate; delinquencies went undetected for several years. And, in addition, city and county funds were being used to pay for work that should have been paid for by the individuals or the organizations for whom the work was done. At this time there was little about Pittsburgh that would invite outside capital to establish business here.²⁸

It was at this time, however, that the railroads were moving westward and bringing about a substantial revival of business. New businesses flourished, and in May 1853 banks declared a 4 per cent dividend. This prosperity increased the demand for more banks and larger capital for the old ones. Enthusiasm over the expansion of the railroads brought

²⁶ Cushing, *et al.*, *op. cit.*, p. 621.

²⁷ Killikelly, *op. cit.*, pp. 193-4.

²⁸ Wilson, *op. cit.*, p. 723.

about much speculation; this was characteristic not only of Pittsburgh but of the whole country. There was an increase in the number of banks and the amount of paper money being circulated; the result was a tremendous inflation of prices which was favorable to imports. Imports exceeded exports more and more, and the tariff of 1846 was criticized; the confusion of the business world grew steadily worse with the tariff of 1857 and the ending of the Crimean War, until it reached its climax with the Panic of 1857.

As in the Panic of 1837, Pittsburgh fared better than most cities, although many banks suspended specie payment and business and industry were at a standstill. The city's better fortune was due to the fact that local financial institutions had been cautious in making loans.

Protectionists had put the blame for the panic entirely on the lack of an adequate protective tariff, and it was not long before manufacturers were demanding tariffs favoring domestic industry. The Morrill Tariff of 1860-61 was the result; specific duties replaced ad valorem and duties on wool and iron were raised considerably.

During the decade there had been little increase in the population of Pittsburgh and the promise of prosperity with the coming of the railroads had not materialized. Except for the success of the Drake well in 1859 the general feeling was not optimistic, and the threat of war hung over the nation.

War began with the fall of Fort Sumter in April 1861, and Pittsburgh was quick to begin production of supplies for the northern forces. The ship building industry revived with the construction of both sea-going and river monitors and gunboats. Local factories turned out various munitions from small arms to twenty inch guns; and in the Fort Pitt Foundry was developed a new process for toughening metal to be used in big guns by playing jets of water on the metal as it cooled.

The business of the district was further encouraged by the passing of favorable tariffs, especially those of 1862 and 1864, so that in the six years from 1860 to 1866 business had increased by \$21,000,000 and the population had doubled.²⁹ At that time, too, the local petroleum market was developing and bringing a large amount of capital into the area.

This prosperity continued for most of the 60's in spite of confusion in financial matters. By 1870 the city had a population of 86,076 and a capital investment in its industries amounting to more than \$100,000,000.³⁰

The start of the new decade held little promise, for business activity had begun to decline following the war's excitement. There was much

²⁹ Killikelly, *op. cit.*, p. 213.

³⁰ Cushing, *et al.*, *op. cit.* p. 621.

inflation and speculation; the first two years saw the establishment of more than twenty banks and trust companies in Allegheny County. The pattern was the same as for the periods preceding previous panics, but no one wanted to recognize it even after the failure of Jay Cooke and Company in New York had set off a chain reaction of business and bank failures. The panic resulted in distrust of financial institutions among the industrial and middle classes, which made recovery slow.

The mid '70's brought a new industry to Pittsburgh—natural gas. Again fresh capital flowed into the district and several companies were formed, chief among them being the Philadelphia Company. In spite of reverses in fortune, Pittsburgh was making some forward progress. In July 1876, the Chamber of Commerce was chartered, replacing the Board of Trade. It set out to make Pittsburgh known throughout the world and to bring about improvements on both a local and national scale.

Adding to the confusion of the time was the first major strike in the area. The railroad strike of 1877 was marked by violence and destruction of life and property by mobs who were in no way involved in the dispute between the railroad men and the companies. The rioting reached such proportions that it was necessary for local authorities to call for help from the militia.

In spite of such disturbances, however, the '70's brought much civic improvement with the installation of a paid fire department, the establishment of new water works, the building of bridges to keep pace with the needs of growing population and the building of skyscrapers to house the offices of the growing corporations. By the end of the period Pittsburgh's population had grown to 156,389 persons.³¹

It was stated previously that Pittsburgh's development into a great industrial city was due not only to her abundance of natural gifts, but to the fact that men of remarkable ability directed the early growth of manufactures. At the end of the nineteenth century there were a number of such men—Westinghouse, Carnegie, Phipps, Frick, Mellon, and B. F. Jones—who were building tremendous industrial and financial empires. They were responsible for making Pittsburgh known as the center of power and wealth.

Trade unions had been growing in numbers and in strength throughout the 1800's, but because of the effective work of the men mentioned above in building up powerful organizations, labor unions were almost completely wiped out by the end of the century. Organization of iron

³¹ *Ibid.*, p. 621.

and steel workers began in 1866 with the formation of Local 8 of the Associated Brotherhood of Iron and Steel Heaters and the Iron and Steel Roll Hands in 1868. These two later joined with the Sons of Vulcans to form the Amalgamated Association of Iron and Steel Workers in August 1876. The organization developed many able leaders, and its success can be seen from the fact that membership increased from 3,755 in 1877 to more than 20,000 five years later.

Between 1880 and 1890 "Amalgamated" unionized every iron foundry in Allegheny County. The success there led the union to attempt the unionization of the steel mills, and here it met real opposition. When the Pittsburgh Bessemer Steel Company opened its Homestead plant in 1881, it announced that the mill would be nonunion. The mill workers refused to sign the "yellow dog" contracts; and when they went on strike on March 6, 1882, they were evicted from company houses. This aroused great feeling among strikers and the public in general and Pittsburgh's first steel strike was marked by violence and bitterness.

Other attempts at unionizing the steel mills were made, and many were unsuccessful; but "Amalgamated" flourished in the iron industry. The union was crushed, however, in 1892; and it was never quite able to recover. When Frick joined the Carnegie Company in 1889, he demanded the dissolution of the union though he extended the company's contract with it until 1892. And, in that year he presented a scale of wage reductions for all workers and demanded that the union accept it, or the company would make individual agreements with the men. While negotiations were carried on, Frick had the plant barricaded, armed the guards, and hired three hundred Pinkerton detectives. It was the latter move that aroused the workers; they met the detectives as they arrived, and in the battle that followed twenty-five persons were killed. The detectives withdrew, and state troopers replaced them. The strike continued for six months and spread to other mills until the union treasury was depleted and the men went back to work in November as nonunion workers. This was a blow from which "Amalgamated" never recovered, as one mill after another outlawed the union and refused to renew contracts.³²

The times were not favorable to the growth of labor unions, since the country had not yet recovered from the depression which came with the close of the Civil War. Employment was scarce and workers were forced to accept jobs on terms dictated by employers. This slump continued,

³² Kelly, George E., *Allegheny County, A Sesqui-Centennial Review*, Allegheny County Sesqui-Centennial Committee, Pittsburgh, pp. 123-7 (1938).

in spite of periodic spurts in production, until the currency of the nation was established on a gold basis with the passing of the Gold Standard Act in 1900. The period of the depression had been favorable to the consolidation of business enterprises, and a number of corporate reorganizations developed from insolvencies of the '90's. A new concept of corporate finance developed that brought about a considerable amount of promotional activity at the turn of the century.³³

With the change in industrial organization which came with corporate mergers and the seeking of world markets for American goods, manufacturing activity continued quietly. The city and its industries grew steadily so that by 1910 the population of Pittsburgh and Allegheny was 533,905, and the suburbs added an additional 429,558 persons.³⁴

By 1914 the original industrial monopolies had reached their initial limits, and some of the more ambitious had been dissolved by the courts. Business and industrial activity was beginning to decline, and another major depression may have developed had it not been for the beginning of World War I.³⁵

Munitions' production began in Pittsburgh in 1914. The first to receive an order from a foreign government for war materials was the Westinghouse Electric and Manufacturing Company. The company began "all-out" production for Britain, building within twenty-nine days, a plant with a capacity of five thousand shells a day.³⁶

Pittsburgh's mills were flooded with war orders: rifle grenades for the Italians; freight and locomotive car brake equipment and grenades for the French; cartridge cases and railroad brake equipment for the Russians; and all kinds of shells and guns for the British. Local factories were also turning out large quantities of unfinished goods for Europe, and the mines were producing 75 per cent of the coal being used by the manufacturers of war supplies in the United States.

The city was known as the arsenal of the world long before our entry into the conflict on April 6, 1917, for Pittsburgh steel was "everywhere along the battlefield."³⁷ Two hundred and fifty war plants, employing 500,000 persons were in operation day and night seven days a week.³⁸ With the declaration of war by the United States production boomed; on November 1, 1918, the United States had war contracts in the area

³³ Graves, Lloyd M., *The Great Depression and Beyond*, The Brookmire Economic Service, Incorporated, New York, p. 20 (1932).

³⁴ Kelly, *op. cit.*, p. 138.

³⁵ Graves, *op. cit.*, p. 21.

³⁶ Harper, Frank C., *Pittsburgh of Today, Its Resources and People*, volume 1, American Historical Society, New York, p. 396 (1931).

³⁷ *Ibid.*, p. 395.

³⁸ *Ibid.*, p. 397.

amounting to \$215,405,000.³⁹ Allegheny County sent 60,000 men into the military services; labor became critically scarce and young boys and old men and women were called on to fill the vacancies in the factories.

Local industries were responsible for several inventions during the war; among them was a new forging process to produce a stronger metal for use in guns. Presses worked the steel in the same direction from which the strain of firing would come. Gas masks were developed at Mellon Institute and the United States Bureau of Mines in time for them to be used to save innumerable lives when the Germans launched their gas attacks. And, Dr. Rosanoff of Mellon Institute was chiefly responsible for the development of aviation gasoline.

The signing of the Armistice on November 11, 1918, brought a sudden cessation in industrial activity and a short depression which continued until 1922, when business recovered sharply because of the reconstruction boom. Most of the decade of the twenties was a period of marked prosperity for the district. The tonnage of Pittsburgh's rivers and railroads was greater than the combined tonnages of the world's four largest ports.

The steel mills which constitute 80 per cent of the city's industry, employed 90,000 men producing one-third of the nation's steel output, and 90 per cent of the nation's vanadium. Production of finished rolled steel and pig iron totaled nearly 20,000,000 tons.⁴⁰

The district's 350 mines employed 40,000 miners with a daily payroll of \$200,000. Working at capacity, the mines were capable of turning out 100,000,000 tons of coal a year. Forty per cent of the nation's coal was produced in the area, and 25 per cent of the nation's coke came from the Connellsville ovens, which had a weekly production of 200,000 tons. Other ovens in this district made the total production of coke in the area equal to 50 per cent of that of the entire country. Most of the coke, however, was used locally.⁴¹

The electrical industry in Pittsburgh is synonymous with the name of George Westinghouse. From small beginnings with the invention of the air brake and the establishment of the Union Switch and Signal Company, Westinghouse enterprises in electrical and railroad equipment had grown until in the 1920's the company owned and operated, directly or through subsidiaries, twenty-five groups of factories in seven states and Canada. In 1920 the company had begun the manufacture of

³⁹ *Ibid.*, p. 400.

⁴⁰ *Pittsburgh's Industrial Predominance*, The Chamber of Commerce of Pittsburgh, James McMillin Printing Company, Pittsburgh, p. 4.

⁴¹ *Ibid.*, p. 5.

radios and radio equipment, and in 1927 it developed and began production of the Diesel engine. In 1927 the annual business of the corporation amounted to \$187,000,000 and locally it employed more than 25,000 persons.⁴²

The railroad industry developed simultaneously with electrical manufacture. The area produced 50 per cent of the steel railroad cars in this country and twelve thousand men were employed in the manufacture of railroad equipment.⁴³

The district's major industries were iron and steel, coal and coke, electrical manufacture, and the manufacture of railroad equipment. There were, in addition, three hundred other lines of diversified industry, most of them allied with metals. The glass industry still prospered; there were sixty-two glass factories in the district employing 25,000 workers and having an annual production of \$10,000,000.⁴⁴ Pittsburgh's petroleum interests were world wide; local capital and talent were developing fields in Central and South America. The aluminum and radium industries were newly established, and the area had the largest food preserving and cork manufacturing plants in the world. The total capital investment in the Pittsburgh area was \$2,000,000,000. Local industries employed 500,000 persons who produced annually \$3,000,000,000 worth of goods; of this amount \$200,000,000 was produced by the minor industries.⁴⁵

Pittsburgh enjoyed prosperity until business activity reached a peak of 125 per cent of normal in 1929. With the crash it began a sharp decline. During the depression which lasted from 1930 until 1936, Pittsburgh suffered greatly. The major part of depression unemployment is among producers of durable goods, and during this period it constituted 79 per cent of the nation's total unemployment.⁴⁶ As business houses and factories closed in rapid succession Pittsburghers wished for the return of smokey skies, for they were a sign of the city's prosperity. The depression was at its worst in the early part of 1933, when business activity was only 41.6 per cent of normal.⁴⁷

Recovery was very slow in spite of attempts of the national government to stimulate a return to normal with the institution of the C.C.C.,

⁴² *Pittsburgh and the Pittsburgh Spirit*, The Chamber of Commerce of Pittsburgh, pp. 226-9.

⁴³ *Pittsburgh's Industrial Predominance*, p. 8. ⁴⁴ *Ibid.*, p. 11.

⁴⁵ Ayres, Leonard P., *The Chief Cause of This and Other Depressions*, The Cleveland Trust Company, p. 29 (1935). ⁴⁶ *Ibid.*

⁴⁷ *Index of Business Activity in the Pittsburgh District 1884-1937*, Bureau of Business Research, University of Pittsburgh.

W.P.A., and N.R.A. In fact, the action of the national government may have retarded recovery, since many feared the increase of federal controls.

The period of recovery, because of the benevolent attitude of the New Deal, was favorable to the growth of labor unions. All local trades renewed their efforts to unionize the industries. In June 1936, the Steel Workers Organizing Committee held its first meeting and chose Philip Murray to head it. In nine months the United States Steel Corporation signed a contract providing a minimum wage of \$5.00 a day, the forty hour week, paid vacations, seniority rights, and machinery for settling grievances. Within two years the S.W.O.C. had contracts with 529 mills.⁴⁸

The United Mine Workers of America had been a strong union, but during the depression paid membership in the district fell from forty thousand to less than two thousand. With the coming of the New Deal, however, an intensive campaign was conducted, and by 1938 most of the mining area was unionized.

Unionization of other industries paralleled the growth of the S.W.O.C. and United Mine Workers, and by 1938, 300,000 men and women in Allegheny County were members of labor unions.

Because of the troubled European scene and the confusion in national policy there were lapses in the reconstruction period of the 1930's. There was progress made, however, and by 1940 Pittsburgh had a total of four thousand industries and was known as the "city of power" since much of the nation's industry was dependent on manufactures here. In 1941, railroad traffic totalling 163,594,933 tons exceeded the tonnages of either New York or Chicago, and river traffic of 38,000,000 tons exceeded that of the Suez Canal.⁴⁹

The manufacture of war materials for foreign governments was begun before the United States actually entered World War II in 1942, but the great expansion of industries did not take place until that time. Both the aluminum and steel industries spent \$700,000,000 to increase plant facilities. During the first year of the war the area produced 86,200,000 tons of steel, more than was produced in Germany during that country's preparation for war from 1933 to 1939. By 1944 the steel output had increased by more than three million tons. During the war, Pittsburgh's munitions production amounted to \$19,000,000,000.⁵⁰

⁴⁸ Kelly, *op. cit.*, pp. 127-8.

⁴⁹ Harper, *Men and Women of Wartime Pittsburgh and Environs, A War-production Epic*, Pittsburgh, p. 4 (1945).

⁵⁰ *Ibid.*, p. 387.

The Westinghouse plants stepped up production 300 per cent, spending \$128,000,000 on expansion. In 1942 production of war goods reached \$500,000,000 and sale of consumer goods exceeded \$1,000,000,000. Total production in the area increased 186.8 per cent in comparison with 1939; iron and steel production rose to 202.6 per cent and coal to 168.1 per cent.⁵¹

Pittsburgh's first great industry, ship building, returned. Many had forgotten that 140 years before a tiny vessel built here had made its way to Italy. Two companies undertook the construction of landing ships: The American Bridge Company, a United States Steel Subsidiary, and the Dravo Corporation. They employed thirty thousand persons, and in 1943 their contracts exceeded \$1,000,000,000.⁵²

The war also developed a new industry here. When natural rubber supplies were cut off, the Koppers Company began production of synthetic rubber at two plants, Blaw-Knox and Kobuta. The Kobuta plant produces butadiene and styrene used in the production of synthetic rubber. The plant turns out annually 37,500 tons of styrene and eighty thousand tons of butadiene. It is the largest producer of synthetic rubber chemicals in the nation.⁵³ The Blaw-Knox plant is capable of manufacturing 735,000 tons of Buna-S rubber a year, 86 per cent of the nation's synthetic rubber program.⁵⁴

The drafting of men into the armed forces created a critical labor shortage; 100,000 new workers were needed. Most of the vacancies were filled by women, thirty thousand of them being employed in war plants and many others taking on men's work in other fields.⁵⁵ It was this employment of women at men's work that created one of the difficult phases of postwar adjustment. Women were reluctant to leave lucrative positions in the mills to return to their old jobs.

The cessation of hostilities brought a sharp decline in industrial production which lasted only as long as it took to change from war to peacetime production, for the demand for consumer goods was high and manufacturing activity continued at a vigorous pace especially in the construction field.

During the period immediately following the war there were a number of big strikes in which the chief issue was wage increases to keep pace with the rising cost of living. During the war there had been strikes in the coal and steel industries, but they were of short duration both because of legislative curbs and because of public opposition to strikes

⁵¹ *Ibid.*, p. 5.

⁵² *Ibid.*, pp. 14-16.

⁵³ *Ibid.*, p. 350.

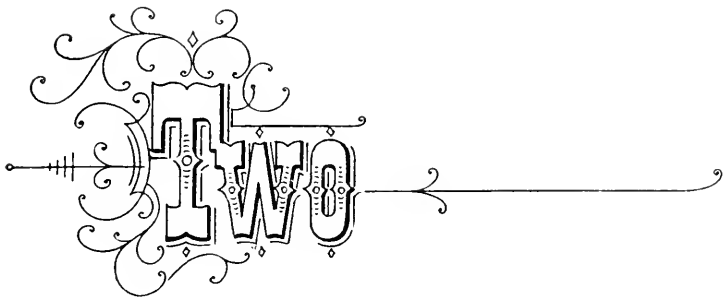
⁵⁴ *Ibid.*, p. 18.

⁵⁵ *Ibid.*, pp. 11-13.

in wartime. The steel strike in 1946 idled 1,380,000 workers and its cost in lost wages and sales was \$300,000,000. The nation lost 10,000,000 tons of ingots and steel for casting.⁵⁶

The pattern of postwar recession had not set in partly because of attempts to control inflation by legislation. Pittsburgh's progress was continuing not only with the area's original industries but with the growth of new ones introduced during the war. A century and a half after the area's manufacturing beginnings, men of outstanding intelligence were still making use of the region's natural advantages and seeking new industrial fields to conquer.

⁵⁶ *The Pittsburgh Sun-Telegraph*, February 16, 1946.



MEASUREMENT OF LONGEVITY
AND ANALYSIS OF FACTORS
CONTRIBUTING TO SURVIVAL
OF MANUFACTURING GROUPS

ALL MANUFACTURERS

There were 434 firms identified as manufacturers listed in the 1856 directory for Pittsburgh and surrounding cities. This is the first year the Pittsburgh and Allegheny directory was published on an annual basis.⁷ Table I shows the number and percentage of these firms classified in each manufacturing group. Approximately one of every 3.7 was classified under the heading "Iron and Steel and Their Products," one of every six under the title "Wood and Its Products," and one of nine under "Food Products." These three manufacturing divisions included over 55 per cent of the total number of firms in operation in 1856.

TABLE I
MANUFACTURING CONCERNS EXISTING IN 1856
(CLASSIFIED BY MANUFACTURING GROUPS)

<i>Manufacturing Group</i>	<i>Number of Firms</i>	<i>Per cent* of Total Firms</i>
Chemicals	15	3.5
Food	49	11.4
Leather	26	6.1
Metals, Iron and Steel.....	124	27.9
Metals, Nonferrous	34	7.9
Petroleum	1	.2
Printing	35	8.1
Stone, Clay, Glass	46	10.6
Wood	69	16.1
Not Elsewhere Classified	35	8.1
Total	434	99.9

*Rounded Off.

The age of these 434 firms ranged from one to sixty-four years.^A However, only four or less than 1 per cent of the total number of firms, were more than forty-five years of age. Twenty-three, or 5.3 per cent, had lasted thirty years; sixty-five or 15 per cent, were twenty years old; and 179, or 41.2 per cent, were ten years of age.^B Approximately 27 per cent were in their first year of development, and the median age was 7.4 years.

During the period from 1856 to 1873 inclusive, 1,534 new manufacturing concerns started in Allegheny County. These enterprises added

⁷ See Appendix V. Such reference letters throughout this section refer to appendices identified by the same letter.

to the 434 firms already existing in 1856 meant that 1,968 different establishments could have been in business in 1873. Nearly 60 per cent of these firms, however, had passed from the records by 1873. Approximately twenty-nine of every hundred firms were listed in only one year. Altogether 1,143 firms disappeared from the business directories, leaving 825 concerns listed in 1873.

Table II shows, for each year of the period 1856 to 1873 inclusive, the number of firms entering, the number leaving, and the total number engaged in manufacturing. The "Number of Entrances" indicates the businesses each year which were not recorded in the previous year. The "Number of Exits" signifies the concerns listed in the previous year but not shown in the specified year which were presumed to have gone out of business within the year. Thus, the total number of firms in a given year, as given in the "Total Number Recorded" column, equals the total of the previous year, plus the number of entrances, less the number of exits in the subsequent year.

TABLE II
NUMBER OF ENTRANCES AND EXITS FROM MANUFACTURING
AND THE TOTAL NUMBER OF FIRMS RECORDED EACH YEAR
FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	<i>Number of Entrances</i>	<i>Number of Exits</i>	<i>Total Number Recorded</i>
1856	..	..	434
1857	58	56	436
1858	91	23	504
1859	88	61	526
1860	35	190	371
1861	43	22	392
1862	48	27	413
1863	74	29	458
1864	70	38	490
1865	57	32	515
1866	67	40	542
1867	96	33	605
1868	163	76	692
1869	148	87	753
1870	153	85	821
1871	158	114	865
1872	115	135	845
1873	75	95	825
Total	1534	1143	

Considering first the total number of manufacturing concerns recorded yearly, it is to be noted that this number increased every year except for 1860, 1872, and 1873. In all other years entrances exceeded exits. Also, in these three there was a decline in entrances as compared with the year immediately preceding. Consequently, the relatively smaller number of firms found in these three years was the result both of the comparatively smaller number of entrances and the larger number of exits. The decrease in 1860 probably resulted from a combination of the prevailing failure rate¹ and the method employed in publishing that year's business directory, which excluded nonsubscribing firms from the directory's listings.² The continuation of this practice undoubtedly reduced the number of firms appearing in the years subsequent to 1860. The decreased number of firms in 1872 and 1873 coincided with the prevailing economic conditions.

When the number of exits in a given year is compared with the number of entrances in the immediately preceding year, a rather close correlation is revealed. With the exception of the years 1860, 1866, and 1867, every decrease in exits was preceded by a decrease in entrances the year before; and every increase in exits was presaged by an increase in entrances a year earlier. These conditions indicate that the number of firms withdrawing each year had little influence on the number of entrances in the same year or the following year and that a large proportion of the firms which commenced operations retired within a year.

When the correlation between the number of entrances in business during a given year and the exits from business in the year immediately following is subjected to the test of correlating the percentage of entrances in a given year with the percentage of exits in the subsequent year, there is a distinct reduction in the degree of correlation. In addition to the nonconforming years of 1860, 1866, and 1867, Table III shows the additional uncorrelated years of 1869, 1871, and 1872. Nevertheless, there still remains a correlation between the percentage of firms entering business in a given year and those withdrawing in the year immediately following.

The median percentage of entrances was 15.3. Those years which indicate a percentage of entrances in excess of the median rate represent the years in which there was a high level of business activity. But, the medial percentage of exits of 11.2 was exceeded both in years of high and of low business activity. Therefore, instead of years with high mor-

¹ Dun & Bradstreet, Inc. (1857-1946, inclusive).

² Thurston, George H., *Pittsburgh and Allegheny Directory*, p. 5.

tality rates reflecting only periods which severely tested survival ability, they may also indicate the withdrawal of young organizations which were unduly influenced to enter the manufacturing field because of the prosperity of the period.

TABLE III
PERCENTAGE OF ENTRANCES AND EXITS FROM MANUFACTURING
AND THE TOTAL NUMBER OF FIRMS RECORDED EACH YEAR
FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	<i>Percentage of Entrances</i>	<i>Percentage of Exits</i>	<i>Total Number Recorded</i>
1856			434
1857	13.4	12.9	436
1858	20.9	7.3	504
1859	15.5	11.9	526
1860	6.7	36.1	371
1861	11.6	5.9	392
1862	12.2	6.9	413
1863	17.9	7.0	458
1864	15.3	8.3	490
1865	11.6	6.6	515
1866	13.0	7.8	542
1867	17.7	6.1	605
1868	26.9	12.6	692
1869	21.4	12.6	753
1870	20.3	11.3	821
1871	19.2	13.9	865
1872	13.3	15.6	845
1873	8.9	11.2	825

The 825 manufacturing establishments existing in 1873 represented a slightly better than 90 per cent increase over the number of firms operating in 1856. Table IV shows the number and percentage of these firms classified in each manufacturing group. Although the number in each division of manufacturing increased between 1856 and 1873, when the percentage of the total firms which were classified under each manufacturing group in 1873 is compared with that group's per cent of the total firms in 1856, only the chemical, leather, nonferrous metal, stone, clay, and glass, and petroleum divisions show gains. Those classed under the titles "Food," "Iron and Steel," "Printing," "Not Elsewhere Classified," and "Wood," however, have lost in their percentage of the total firms recorded.

TABLE IV
NUMBER AND PER CENT OF MANUFACTURING CONCERNS
EXISTING IN 1873 CLASSIFIED BY
MANUFACTURING GROUPS

<i>Manufacturing Group</i>	<i>Number of Firms</i>	<i>Per cent* of Total Firms</i>
Chemicals	35	4.2
Food	63	7.6
Leather	63	7.6
Metals, Iron and Steel	206	25.0
Metals, Nonferrous	95	11.5
Petroleum	37	4.5
Printing	53	6.4
Stone, Clay and Glass.....	94	11.4
Wood	118	14.3
Not Elsewhere Classified	61	7.4
Total	825	99.9

*Rounded Off.

The age of the 825 manufacturers in 1873 ranged from one to seventy-two years.^c Nineteen, or 2.3 per cent of the total number of firms, were in existence for forty-five years. Seventy-one, or 8.6 per cent, had lasted thirty years; 143, or 17.3 per cent were twenty years of age, and 321, or 38.9 per cent were at least ten years old.^p Approximately 9.7 per cent were in their first year and the median age was 7.0 years.

A comparison of the percentages of firms at forty-five, thirty, twenty, and ten years of age in 1873 with firms possessing similar longevity in 1856 shows a higher percentage of firms in each of these categories in 1873. Yet, the median age in 1873 is lower than in 1856. This condition resulted from there being a larger percentage of surviving firms in 1873 which originated during the second to sixth year period immediately preceding 1873 than there were firms in 1856 which originated during a similar time.

Of the 229 firms which were at least seven years of age in 1856, 114 survived to 1873. Only 653 of the 1,534 firms originating during the period of 1857-1873 inclusive, however, were listed in the 1873 directories. Also, thirty-six of sixty-five firms which were at least twenty years old in 1856 were included in the 1873 listings. These and other comparisons of the ages of the firms listed in 1873 with the ages of the same firms in any given previous year indicate that, up to fifty-five years of age, the older the firm was, the greater was its chance of continued survival.

The analysis of factors contributing to the longevity of manufacturers which have survived at least seventy-five years eliminates the inclusion of those firms originating subsequent to 1873. Consequently, entrances of new manufacturing enterprises were not tabulated for the 1874-1947 period. Instead, the statistical measurement was confined to a consideration of exits or continued existence of those which were listed in the 1873 business directory.

By 1947, only thirty or 3.6 per cent of the 825 firms working in 1873 were still in independent operation;^E 795 or 96.4 per cent of the firms had failed, experienced a complete severance in ownership, moved out of Allegheny County, lost identity through mergers, or still continued as a division or subsidiary of a consolidated company.

The 96.4 gross mortality percentage divided equally over the seventy-four years comprising the possible exit period gives a yearly average mortality rate of 1.3 per cent. But, 1902 is the only year to duplicate exactly the average mortality rate.^E Twenty-four of the twenty-eight years preceding 1902 have a mortality rate in excess of the average rate. Only one of the forty-five years following 1902, however, shows a mortality rate which exceeds the average rate. Of course, this condition partly results from the method employed in determining the mortality rate. For instance, if 100 per cent of the thirty firms surviving from 1873 to 1947 should fail in 1948, the mortality rate would be computed as 3.6 per cent of the 825 firms which might possibly have failed that year.

Perhaps a better measurement of the yearly mortality is obtained from computing the exits in a given year as a percentage of the firms existing in the year immediately preceding instead of basing the percentage on the number of firms existing in 1873. The use of this method indicates a mortality rate ranging from zero for the years 1922, 1928, 1929, 1937, 1942, 1943, 1944, 1945 and 1946 to 8.2, 8.3, 8.7, 8.9, 9.6, 10.2 for 1900, 1917, 1877, 1874, 1935 and 1934, respectively.^F

This method also presents difficulty when employed to measure the percentage relationship existing between two small numbers. For example, the 100 per cent mortality rate in the petroleum industry for the year 1906^F does not indicate that 1906 was ten times as critical a period as was 1886 but that 100 per cent of the firms listed in 1905 discontinued operations in 1906.

The mortality rates of the 1874-1947 period are not entirely subject to the limitations affecting the rates computed for the 1857-1873 period. This condition arises from elimination of exits resulting from the with-

drawal of newly established firms by ignoring entrances subsequent to 1873. Consequently, periods of high mortality occurring after 1873 more validly represent periods which seriously tested a concern's ability to continue.

As pointed out before, the computation of mortality rates was a secondary objective in tabulating the manufacturing enterprises listed in the business directories. The primary objective was the establishment of the average length of life of manufacturing firms located in Allegheny County in order to identify those existing concerns which had experienced above average longevity.

Appendix E shows the number and the percentage of manufacturing concerns existing in 1873 which survived each year of the period 1873-1947. Of these, 431, or 52.2 per cent, were listed for thirteen years, and 410, or 49.7 per cent, for fourteen years. The median age was approximately 13.88 years. This figure almost doubles the median age of manufacturers existing in 1873 and 1856, 7.0 and 7.4 respectively. Caution must be exercised, however, in using the median age of 13.88 years since it was computed from the longevity experience of established concerns except for those originating in 1873. Although 13.88 years could not be accepted as the median age obtained by all manufacturing concerns located in Allegheny County during the 1873-1947 period, it does establish the median age reached by those operating in 1873.

Seventy-three of the 825 firms listed in 1873 were not recorded in the 1874 directory. Fifty-six firms were not listed after 1874, and twenty-seven did not appear after 1875. Unusual variations in the number of firms which ceased to be listed in various years occurred in the fifth, twenty-eighth, twenty-ninth, forty-fifth and forty-eighth years.⁶ The prevailing economic conditions largely explain all of these variations with the exception of those appearing for the twenty-eighth and twenty-ninth years. The large increases associated with these two years reflect the affect of mergers and consolidations in the manufacturing divisions of food and iron and steel.

The determining of the number of years each firm existed during the 1873-1947 period made possible the computation of the median age experienced by all firms during those seventy-five years. But, this method ignored the years the firms had operated prior to 1873. In order to arrive at a more valid average age, the number of years each firm was listed during 1856-1947 period was included in the computation. Although this method would seem to increase the median age of manufacturers by increasing the age of those firms existing in 1873 by the

number of years they were listed during the 1856-1873 period, it also tends to decrease the median age by including those firms which operated during the 1856-1873 period but failed to survive to 1873.

Of the 1,968 firms accounted for during the period of 1856 to 1873, inclusive, 562 were listed only one year, 216, two years, and 138, just three years.^H Those listed for four years totaled 1,052, or 53.5 per cent; and those appearing for five years came to 918, or 46.6 per cent. Fifty per cent, or 984 manufacturing establishments, reached an average age of 4.51 years. The decrease of 9.37 years from the 13.88 median age reached by those firms in existence in 1873 results from the latter figure's ignoring entrances after 1873 and the former figure's including 1,534 entrances between 1856-1873.

The median age of 4.51 years experienced by manufacturers which were listed during the 1856-1873 period was obtained by using 1856 as the first year of their existence. Such was not the case. As pointed out before, 434 firms were listed in 1856, and they then possessed an average age of 7.4 years. The determining of the true average age acquired by all manufacturers during the 1856-1873 period would necessitate the inclusion of the years of operation by those manufacturers prior to 1856. Such an average, however, would represent a hybrid type of figure since it would not include those firms which started but failed to survive to 1856, nor those which originated subsequent to 1873; but, it would include those concerns existing before 1856 and subsequent to 1873 provided they were listed during the 1856-1873 period. Furthermore, it would include those firms which both operated and failed during the 1856-1873 period. Nevertheless, it would represent the most accurate average age for manufacturers existing during the 1856-1873 period, which is obtainable under the conditions employed in making this investigation.

When consideration was given to the total years of existence of concerns listed during the 1856-1873 period, 540 firms appeared for just one year, 205 for just two years, and 122 for just three years. Those listed for five or more years numbered 1,007 or 51.2 per cent; and manufacturers listed for six or more years totaled 945, or 48.0 per cent.^I Fifty per cent, or 984, had an average age of 5.37 years. This represents an increase of .86 years over the average age computed for the 1856-1947 period when no consideration was given the years of operation prior to 1856.

The average length of life attributable to manufacturing concerns existing during the 1856-1873 period varied according to the period involved in the computation of the median age. The three periods of

1873-1947, 1856-1947, and 1793-1947 gave a median life of 13.88, 4.51, and 5.37 years respectively. Table V shows the percentages of firms in each of these three time groups which survived for various numbers of years.

TABLE V
PERCENTAGE OF MANUFACTURING CONCERNS SURVIVING FOR
SELECTED PERIODS OF TIME

<i>Number of Years</i>	<i>Per cent of Firms Existing during 1856-1873 Which Survived for Various Years of the 1793-1947 Period</i>	<i>Per cent of Firms Existing during 1856-1873 Which Survived for Various Years of the 1856-1947 Period</i>	<i>Per cent of Firms Existing in 1873 Which Survived for Various Years of the 1873-1947 Period</i>
1	100.0	100.0	100.0
2	72.6	71.4	91.1
3	62.1	60.5	84.4
4	55.9	53.5	81.1
5	51.2	46.6	74.1
10	39.4	35.1	57.2
15	31.7	27.9	47.0
25	21.2	18.8	29.8
35	14.3	12.1	17.3
45	9.5	7.7	10.7
55	6.1	4.4	7.5
65	4.2	3.1	4.8
75	3.2	2.2	3.6
90	1.2	.86	....
105	.5	....	....
120	.2	....	....
135	.05	....	....
145	.05	....	....

The relatively higher survival percentages of the 1793-1947 and the 1873-1947 groups reflects the benefits derived from excluding from the computations those entrances pertaining to the 1793-1856 and 1873-1947 periods. This is especially noticeable in the percentages belonging to the 1873-1947 group. Additionally, the exclusion of entrances shows the greatest advantage during the first few years of existence. It is during these years that most manufacturing concerns discontinue operations.

The median age of manufacturing concerns included in the investigation indicates an age beyond which any concern would be classified as

experiencing above average longevity. This medial age is significant, but it does not supply enough information. For instance, what is the ratio between firms existing in 1873 and those which survived to 1947? In Allegheny County it took 825 firms in 1873 to provide thirty surviving firms in 1947. That represents a ratio of 27.5 to 1; that is, one of every 27.5 firms lasted through the seventy-five year period. But, only one of every 65.6 firms existing between 1856 to 1873 survived to 1947. The ratio of manufacturers still operating in 1946 to those listed in 1856 is 15 to 434, or 1 to 28.93. When this ratio is compared with the 1873 to 1947 ratio of 27.5 to 1, it appears that concerns existing in 1856 had an opportunity of surviving to 1947 almost equal to that of firms listed in 1873. And, then the ratio of firms surviving in 1947 to those existing in 1856 is compared with the ratio of 102.27 to 1 which represents the ratio of firms surviving in 1947 to those entering business between 1856-1873, it appears that the former group had a greater opportunity to survive to 1947 than did the latter. Again, the importance of the age of a concern in considering the possibility of its continued existence is demonstrated, for 72.8 per cent of the 434 concerns existing in 1856 was more than one year old. But, 100 per cent of 1,534 firms which entered business between 1856 and 1873 had that first year barrier to overcome.

Table VI shows, classified by manufacturing groups, the number and percentage of the total firms which survived to 1947. There was considerable changing of the relative percentages of the total firms repre-

TABLE VI
MANUFACTURING CONCERNS SURVIVING TO 1947
(CLASSIFIED BY MANUFACTURING GROUPS)

<i>Manufacturing Group</i>	<i>Number of Firms</i>	<i>Per cent of Total Firms</i>
Chemicals	2	6.67
Food	1	3.33
Leather	0	0.00
Metals, Iron and Steel.....	12	40.0
Metals, Nonferrous	5	16.67
Petroleum	0	0.00
Printing	3	10.0
Stone, Clay, Glass	1	3.33
Wood	4	13.33
Not Elsewhere Classified.....	2	6.67
Total	30	100.00

TABLE VII
PERCENTAGE OF EACH MANUFACTURING GROUP OF THE
TOTAL MANUFACTURING CONCERNS EXISTING IN 1856
AND 1873 AND THOSE WHICH SURVIVED TO 1947

<i>Manufacturing Group</i>	<i>Per cent of Total Firms in 1856</i>	<i>Per cent of Total Firms in 1873</i>	<i>Per cent of Surviving Firms in 1947</i>
Chemicals	3.5	4.2	6.67
Food	11.4	7.6	3.33
Leather	6.1	7.6	0.00
Metals, Iron and Steel.....	27.9	25.0	40.00
Metals, Nonferrous	7.9	11.5	16.67
Petroleum .....	.2	4.5	0.00
Printing	8.1	6.4	10.00
Stone, Clay and Glass	10.6	11.4	3.33
Wood	16.1	14.3	13.33
Not Elsewhere Classified.....	8.1	7.4	6.67

sented by each manufacturing group in 1856, 1873, and 1947. Those changes are shown in Table VII.

The chemicals and nonferrous metals groups increased their percentages of the total firms investigated in both 1873 and 1947. Printing and metals, iron and steel, fell off slightly in 1873 from their positions in 1856. However, their downward trend reversed itself, and they showed substantial gains in their percentage of the total firms surviving to 1947. The groups entitled "Food," "Wood," and "Not Elsewhere Classified" lowered their percentages of the total firms in both 1873 and 1947. The leather, petroleum and stone, clay and glass classifications improved their positions in 1873 but showed decided losses in the 1947 computations. Although iron and steel manufacturers combined with the nonferrous metals group represents 56.67 per cent of the surviving firms in 1947, percentagewise, the best individual showings were made by the chemicals, printing, and iron and steel groups. Each of those groups increased its percentage of the total firms in 1873 by over 50 per cent in the 1947 computations.

The age of the firms surviving in 1947 ranged from 77 to 146 years.⁷ The oldest firm entered business in 1802 and the youngest commenced operations in 1871. Only nine concerns were at least one hundred years of age. Fifty per cent of the firms had existed for ninety-two years or longer; 10 per cent of the firms entered business in 1856; and an additional 10 per cent originated in 1860.

The preceding statistical analysis and measurement of longevity of manufacturing concerns located in Allegheny County during the 1856-1873 period developed information regarding all division of manufacturing. Such information makes possible the comparison of the longevity of a single enterprise with the longevity experienced by all manufacturing concerns. The comparison of an individual enterprise with manufacturing concerns belonging to the same manufacturing group provides a more representative conclusion. There follows a comparison of the longevity of manufacturing concerns by manufacturing groups and an analysis of the factors contributing to the survival of the concerns which have existed since 1873.

CHEMICALS

There were fifteen concerns classified under the chemical manufacturing group in 1856. Their ages ranged from one to twenty-three years.^A Of all manufacturing groups, 11.8 per cent of the concerns were at least twenty-three years of age in 1856;^B so the chemical group included firms of a relatively recent origin. The median age of the firms included in the chemical group in 1856, however, exceeded the median age of any other manufacturing group. The median age of all manufacturing concerns was 7.4 years, whereas, 53.3 per cent of the concerns in the chemical group had existed for thirteen years or more.

In 1873, the median age in the chemical group was 8.5 years as compared with 7.0 years for all manufacturing concerns.^C By 1947, 50 per cent of all the surviving manufacturers had existed for at least ninety-two years. Of the two firms surviving in the chemical group, one was ninety-six and the other seventy-seven years of age.^J Consequently, when the median age of all manufacturing concerns existing in 1856, 1873, and 1947 is considered, the chemical group is placed in a most favorable position.

The median length of life determined for all manufacturing firms existing during the 1856-1873 period varied according to the period included in the computation. The three periods of 1873-1947, 1856-1947, and 1793-1947 reflected a median length of life of 13.88, 4.51, and 5.37 years, respectively. For the same three periods, the chemical manufacturing group had a median length of life of 18.5,^G 9.5,^H and 13.0 years.^I Not only did the chemical manufacturing group have an average length of life which exceeds that of all manufacturing concerns in each of these

three periods, but it also exceeded the average longevity of any single manufacturing group in all three periods.

The thirty-five firms classified in the chemical group in 1873 represented an increase of 133.3 per cent over the number of firms operating in 1856 as compared with an increase of 90 per cent for all manufacturing concerns. The 133.3 per cent increase resulted from forty-five entrances as against twenty-five exits during the 1856-1873 period.^K During this period the median birth rate was 12.1 per cent as against 15.3 per cent for all manufacturers, and the death rate was 5.3 per cent as compared with 11.2 per cent. Fewer firms entered the chemical manufacturing group, but the median mortality rate was less than half of the rate for all manufacturing concerns.

A ratio of 17.5 to 1 represents the number of chemical manufacturers existing in 1873 to those surviving to 1947. Fifteen to one is the ratio between those operating in 1856 and those which lasted to 1947. Of the forty-five firms which entered business between 1856 and 1873, one survived to 1947, and of the sixty firms operating during the 1856 to 1873 period one of thirty survived to 1947. In each of these four ratios, the chemical group shows a decidedly better ability to survive than does the average of all manufacturing concerns.

The various comparisons of the longevity of the concerns in the chemical group with the longevity of all manufacturers definitely indicates its superior survival ability. But, the measurement of longevity has been limited in this study to those firms which had continuity of ownership and continued to operate in Allegheny County. Consequently, several quasi-surviving firms in the chemical group were listed as exits prior to 1947. Included in the exits was the Pennsylvania Salt Manufacturing Company which went under the control of a Philadelphia company in 1873. The Davis-Chambers Lead Company, Beymer-Bauman Lead Company, Armstrong-McKelvy Lead Company, and Fahnestock White Lead Company were succeeded by National Lead Company of Pennsylvania in 1892. (The National Lead Company of Pennsylvania is a wholly owned subsidiary of National Lead Company of New York City, New York.) And lastly, Pittsburgh Plate Glass acquired all of the stock of M. B. Suydam Company, a ninety-one year old concern, on March 31, 1946. Had these six firms met the qualifications established for surviving firms, the chemical group would have had eight concerns of the thirty-five in 1873 lasting through the seventy-five year period until 1947.

There was such a small number of firms classified in the chemical

group in 1873 that the withdrawal of just one results in a mortality rate of 2.86^F per cent. Consequently, the importance of the mortality rates in the chemical group is lessened because of the small number of manufacturers involved. Of greater significance is the number of concerns withdrawing in a given year; after 1878, there were only two years in which more than one withdrew. The four withdrawals in 1893 reflect the acquisition of four lead manufacturers by National Lead of Pennsylvania, and the two withdrawals in 1903 included a soap manufacturer and an acid manufacturer. No withdrawals occurred during fifty-one of the years between 1878 and 1947. It is, therefore, difficult to determine from the mortality records which period seriously tested the ability of a concern to survive.

Thompson and Company,^{U1} a paint manufacturer, and Strunz Soap Company,^{U2} a soap producer, are the two concerns in the chemical group which operated through the 1873-1947 period. Only three years separated the date of origin of these two businesses. During that same three year period, 1847-1850, three other chemical firms were founded. Two of them continued in 1947 as minority interests in consolidated concerns. These records indicate that the 1847-1850 period was an exceptionally favorable time for the establishment of concerns producing chemicals and allied products.

Both Thompson and Company and Strunz Soap Company in 1947 were in the same asset size class. Most of the other concerns in the chemical group were of smaller size while they were included among the surviving firms. Some of the concerns, however, prior to their exclusion from the annual directories, had a net worth which then exceeded the net worth of the two survivors. Although these comparisons do not prove that size is a factor contributing to the longevity of these two firms, the fact remains that they steadily grew over a period of approximately ninety years to a net worth between \$250,000 and \$500,000 and that these firms which have successfully resisted failure, merger, consolidation, or succession are now classified in the same asset size class.

Each of these two concerns has found its location beneficial with regard to sales market, raw materials, power, and labor. Neither firm has encountered significant seasonal fluctuations in demand. Furthermore, they have been faced with a relatively steady, yet expanding, demand which has not been subject to widespread style changes.

A high degree of similarity is reflected in the comparison of the general conditions which have confronted both companies. But, there are several different factors specifically associated with the longevity of

each firm. Those factors contributing especially to the continuance of Thompson and Company are: birth of children within the controlling family who were willing and capable of continuing the business, training of the controlling family's children to accept responsibility in the operation of the business, constant maintenance of a conservative operating policy, periods of ineffective competition, maintenance of an extensive research program, rapid adoption of new machinery and methods of production, and reimbursement for fire losses through maintenance of adequate insurance protection.^{U1}

On the other hand, several factors not associated with Thompson and Company have contributed to the longevity of Strunz Soap Company. They include market control from patents, flexibility in adjusting to new methods of distribution, restricting of operations to the production of a superior product, and economies resulting from restricting marketing activity to a concentrated sales territory.^{U2}

Although some of the factors contributing to the longevity of each of these concerns are not included in the longevity factors associated with the other concern, most recognized by both enterprises are the same. The identical factors are: previous experience of the founders, managerial guidance provided by specific individuals, flexibility in adjusting to the production of new products, limitation of expansion to a readily controllable size, prudent financial policy characterized by extensive reinvestment of profits, advantageous financial connections, favorable employee relations and avoidance of widespread competition through producing unique products.

The source of almost all of the longevity factors associated with these enterprises can be traced to management, but managerial activity may be divided into several distinct categories. Thompson and Company's longevity factors may be classified as follows: three concerning the product; two involving financial condition; three covering manufacturing operation, one administrative action; four, specific individuals; two, origin and reputation; and one, absence of effective competition.^{U1}

The factors contributing to the longevity of Strunz Soap fall into the following categories: four concerning the product; three, specific individuals; two, manufacturing operation; one, financial condition; one, administrative action and one, origin and reputation.^{U2}

Although some of the factors contributing to the longevity of each of these companies are not included in the longevity factors associated with the other, most of the longevity factors recognized by both enterprises are the same.

FOOD AND ALLIED PRODUCTS

Forty-nine concerns were classified in the food and allied products group in 1856.^A Their ages ranged from one to thirty-nine years. Their median age of 5.3 years^B was 2.1 years below that of all manufacturing concerns existing in 1856. Except for the wood and woodworking group, all of the other divisions of manufacturing concerns had a higher median age. The low median age in the food group was due to the relatively large number of recently established brewing concerns.

In 1873, the sixty-three concerns^C classified in the foods' group had a median age of 6.25 years^D which was .75 of a year less than that of all manufacturing firms. Only two of the other nine manufacturing divisions had a higher median age in 1873 than in 1856. The increased median age in the foods group, however, did not validly represent the correct condition. Actually, the median age was inflated by disregarding entrances of baking and confectionery manufacturing concerns from 1868 to 1873. This action resulted from the fact that the 1868 to 1873 business directories listed baking and confectionery retailers and manufacturers under the same category. That arrangement prevented the identification of new manufacturing concerns.

The lone survivor in the food and allied products group in 1947 was seventy-nine years of age.^J In comparison, 50 per cent of all manufacturing concerns which survived the seventy-five year period were at least ninety-two years of age. With the exception of the petroleum and leather groups, which did not have any surviving concerns in 1947, all of the other manufacturing groups included concerns with a higher median age than the one survivor in the foods group.

The three previous comparisons indicated that firms in the food group had a lower median age than all manufacturing concerns in 1856, 1873, and 1947. Furthermore, this group had next to the lowest median age of any group in 1856, the fourth lowest in 1873 and the lowest in 1947. When the 1873 median age is deflated for the unwarranted increase resulting from the exclusions of entrances from 1868 to 1873, the food group gives a composite median age for the three comparative years poorer than any other manufacturing group which included a surviving concern in 1947.

The median age obtained by the firms in the food and allied products group varied according to the period included in the computation. The 1873-1947, 1856-1947 and 1793-1947 periods had a median length of life of 17.5,^G 3.8^H and 4.5^I years respectively. For the last two periods,

the median age obtained by firms in this group was below that reached by all manufacturing concerns. But, the 17.5 median age for the 1873-1947 period exceeded the median age of all manufacturing concerns by 3.62 years. Of course, the 17.5 figure was distorted by the exclusions of entrances of baking and confectionery concerns from 1868-1873. Consequently, the relatively favorable position of the longevity of food concerns in the 1873-1947 period resulted more from the method employed in the calculation than from actual conditions.

Sixty-three concerns were classified in the food and allied products group in 1873. This number represented a 28.6 per cent increase over the forty-nine firms listed in 1856, whereas the average increase for all manufacturing concerns was 90 per cent. No other manufacturing group had such a small increase in the number of firms during the same period. (Once again, the situation was distorted by the treatment given entrances of baking and confectionery concerns between 1867 and 1873.) The net increase of fourteen firms in the food group resulted from 165 entrances as against 151 exits during the 1856-1873 period.^L The median birth rate was 18.7 per cent, which was 3.4 per cent higher than the rate for all manufacturing concerns. The median mortality rate was 10 per cent in contrast to 11.2 per cent for all manufacturing concerns. When the birth rate is compared with the mortality rate, it appears that the number of firms should have increased more than is indicated.

The mortality rate, however, never deviated more than 5.7 per cent below the median rate, but it did deviate more than 5.7 per cent above the median rate in four separate years. In two of these years, the deviation exceeded 20 per cent above the median rate.

A ratio of 63 to 1 exists between the number of food concerns listed in 1873 and 1947; forty-nine to 0 represents the ratio between firms existing in 1856 and 1947. Of the 165 firms entering the industry between 1856 and 1873 and the 214 operating during the 1856-1873 period only one survived to 1947. In each of these four ratios, the food and allied products group shows decidedly poorer survival ability than the average of all manufacturing concerns.

Mergers and consolidations contributed materially to withdrawals of concerns in this classification during the 1890-1900 period. Nine of the seventeen manufacturers withdrawing during this period were eliminated because of the lack of continuity of control. In 1891, S. S. Marvin, a baking concern, was classified as a branch of United States Baking Company, and Francis Felix and Son became part of P. C. Tomson and Company of Philadelphia in 1892. Then, in 1899, seven old breweries

participated in the Pittsburgh Brewery Company merger along with nine additional breweries which had started subsequent to 1873. The seven old establishments had originated under the trade styles of A. Bauerlein; Frauenheim, Miller and Company; Ernest Hauch; John H. Nusser; J. N. Staub and Company; Z. Wainwright; and Ober and Koenig.

Of the food manufacturing concerns which operated in 1873, 98.4 per cent had discontinued business in 1947.^E An equal allocation of the gross mortality rate over the period involved gives an annual mortality rate of 1.34 per cent. The annual mortality rate was exceeded in each year in which a withdrawal was recorded. But, there were forty-six years for which no withdrawals were indicated.^F 1874 and 1900 had mortality rates of 12.7 per cent and 14.3 per cent respectively. The 1874 rate exceeded only slightly the normal rate expected through the withdrawal of firms which originated during 1873. But, the 1900 rate was 12.69 per cent higher than the rate computed for any of the seven years immediately preceding. However, the reduction of the 1900 rate by the percentage of firms withdrawing because of mergers explains its abnormal position.

The computation of a mortality rate based on the number of firms existing in the year immediately preceding the year in which a withdrawal was recorded resulted in high mortality rates for 1900, 1903, 1908, 1909, 1911, 1912, 1917, 1923, 1924, and 1925.^F The 1900 rate has been analyzed. The rates for 1903 and 1908 were increased by the conversion of manufacturers into wholesalers. The 1909 rate was composed entirely of withdrawals of distilling concerns; however, no reason could be established for their withdrawal. Nor could any reason be found for the withdrawal of the baking and distilling establishments which discontinued operations in 1910, 1911, and 1917. But, all firms withdrawing in 1923, 1924, and 1925 were engaged in distilling operations and apparently were victims of the prohibition era.

There were only fourteen concerns in the food and allied products group in 1900. Two of these concerns became wholesalers; three, which were distillers, succumbed in the early part of the prohibition era. Four distillers, three bakers, and one lard manufacturer could not be associated with any specific reason for withdrawal, and one firm survived to 1947.

The surviving firm in the food and allied products group engages in the manufacture and canning of food products under the present style of H. J. Heinz Company, Inc.^{U3} Continuity of control was established in

this firm with its origin in 1869. From a most humble beginning, the company has constantly expanded until it is classified in the \$25,000,000 and over asset group.

Since only one concern survived in the food and allied products group, the comparison of the general factors contributing to the survival of various firms in this manufacturing group is impossible. But, the general conditions confronting a firm engaged in this industry would be similar to those recognized by H. J. Heinz Company. They include the existence of a high seasonal variation prior to the introduction of improved processing and preserving methods, favorable location providing proximity to sales market, raw materials, transportation, power, and labor, and a product demand which, originally undeveloped, has constantly expanded and has been largely unaffected by business recessions.^{U3}

Most of the factors contributing to the longevity of the H. J. Heinz Company can be traced to the action of the management. But, there were distinct types of managerial action involved. Foremost among these types was the overall guidance and administrative action provided by H. J. Heinz, Howard Heinz, and H. J. Heinz, II. Closely related to the guidance furnished by specific individuals was the previous training of the founder, the birth of children in the controlling family who were willing and capable of successfully continuing the concern, the intentional preparation of members in the controlling family to accept executive positions, and the employment of capable administrators.

The second largest group of longevity factors connected with the H. J. Heinz Company may be classified as marketing factors. They include the original introduction of containers made from clear cut glass, the consistent use of extensive advertising, the introduction of Heinz Soup Kitchens, and the elimination of middlemen by maintaining direct sales relations with grocers, hotels, and restaurants.

The third most important group of longevity factors concern the product. This group includes the stabilization of operations through product diversification, early introduction and continued operation of an intensive research and quality control department. Emphasis on superior quality of product has made possible the selling of items at premium prices with public confidence in the quality of the product because of such action as H. J. Heinz's fight for the enactment of Federal Pure Food Laws.

A fourth group of longevity factors involve financial policy. There has been an extensive reinvestment of profits. Whenever possible,

expansion has been planned to coincide with business depressions. Expansion has been largely self-financed. (The initial public offering of the company's stock was made in 1946.) Since the firm's inception, the policy has been toward the retention of adequate working capital.

A control feature has been prominent in the company's operations. Control over raw materials with company owned facilities and numerous contract farmers has been maintained constantly. From raw materials to the sales market, control has been exercised by acquiring and operating any facility which has proved itself profitable. This policy has resulted in the operation of printing and glass plants, transportation facilities, and other activities, as long as it did not appear uneconomical to continue their operation.

The company has developed product differentiation by brand names and has a well established reputation. Excellent labor relations have also contributed to the company's success. But, probably the most important single factor was the timeliness of the company's origin. Pasteur, in 1860, dealt the final blow to the then tottering theory of spontaneous generation. The Civil War popularized the use of canned goods. Consequently, by 1869, a tremendous and undeveloped market was ready to accept canned food products.

LEATHER AND LEATHER PRODUCTS

The leather and leather products' group³ included twenty-six manufacturing concerns in 1856.^A Their ages ranged from one to sixty-four years. Their median age of thirteen years^B was 5.6 years above that of all manufacturers listed in 1856. Only the chemical group had a median age in excess of thirteen years. Furthermore, the oldest 11.5, 19.2, 26.9, and 30.8 per cent of the firms in the leather group possessed ages in excess of the ages held by similar percentages of the oldest concerns in any of the other manufacturing groups. Also, the oldest manufacturing concern listed in 1856 was in the leather group.

The relatively high percentage of long established concerns in the leather group was largely due to the number of tanneries operating in Allegheny County in 1856; thirteen of the twenty-six manufacturers in the group were tanneries. It was natural, because of the demand for

³ Several of the business directories between 1856 and 1873 listed retail boot and shoe firms with manufacturers of boots and shoes, thereby preventing yearly identification of manufacturing concerns. Consequently, in preference to use of unreliable data, all data regarding boot and shoe manufacturers were excluded from this study.

leather products and the number of oak and hemlock forests in western Pennsylvania that tanneries should early take root in Allegheny County and should continue to be a growing industry in the city.

There were sixty-three concerns in the leather group in 1873.^c Only 49.2 per cent of them had been listed in the directories for at least five years.^d Their median age of 4.95 years was 2.05 years below that of all manufacturing concerns existing in that year. Moreover, no other manufacturing group had a median age below 5.37 years. Consequently, the median age of the concerns in the leather group had fallen from the second highest of any manufacturing group in 1856 to the lowest in 1873. This condition was largely the result of the high percentage of entrances in 1871 and 1872 of leather manufacturers which survived to 1873.

None of the leather and leather products' manufacturing concerns survived the 1873-1947 period. One firm continued until 1925, another until 1932, and a third was listed in the directories until 1941. The percentage of the 1873 leather manufacturing concerns which continued operations was beneath the percentage of surviving concerns of all manufacturers of each year of the 1873-1903 period.^e But, from 1904 through 1912 the leather manufacturers had a higher percentage of survivors than the average of all manufacturers. After 1912, the leather concerns rapidly disappeared. This is largely due to the withdrawal of the relatively large number of harness, saddle, and trunk manufacturing concerns because of the displacement of the effective demand for their products which came as the result of the expanded use of motor vehicles.

The 1873-1947, 1856-1947, and 1793-1947 periods reflected a median length of life in the leather division of 12.4,^g 4.5,^h and 6.37ⁱ years respectively. In comparison with all manufacturing concerns, the median age of the leather group was higher for the 1793-1947 period, approximately the same for the 1856-1947 period and lower for the 1873-1947 period. Once again, in relation to other manufacturing divisions, the leather group's superior position prior to 1856 steadily deteriorated as each successive period was considered.

The number of concerns classified in the leather group increased from twenty-six in 1856 to sixty-three in 1873. These thirty-seven manufacturers represented a 142 per cent increase in contrast to a 90 per cent increase in all manufacturing concerns during the same period. Harness, saddle, and trunk manufacturers accounted for a substantial part of the net increase. Actually, forty-three of the seventy-nine entrances into the leather group between 1867-1873 were harness, saddle, and trunk

makers. Forty-one of them still existed in 1873. But, by 1880, most of these firms were no longer listed in the directories.

The increase of thirty-seven concerns between 1856 and 1873 resulted from 115 entrances as against 78 withdrawals.^M The median rate of the entrances was 12 per cent which was 3.3 per cent lower than that for all manufacturing concerns during the same period. The median mortality rate was 6.5 per cent in contrast to 11.2 per cent for all manufacturing concerns.^M However, the median is an exceptionally invalid average in the measure of birth and mortality rates in the leather group. Wide variations in the annual birth rate from 2.6 per cent to 48.7 per cent and 0 per cent to 47.4 per cent for the annual mortality rate prevented the median birth or mortality rate from providing a fair indication of annual changes in the number of leather manufacturers.

Withdrawals from the leather and leather products group because of mergers or consolidations were negligible. Slightly more important was the number of firms which transferred from manufacturing to trading activities. As far as could be determined, almost all of the concerns in the leather group withdrew because of failure or because of sale to a previously unrelated successor.

One hundred per cent of the leather manufacturing concerns which existed in 1873 had discontinued business by 1941. An equal distribution of the gross mortality percentage throughout the 1873-1941 period brought an annual mortality rate of 1.45 per cent. Since a single withdrawal represented a 1.59 per cent of the sixty-three concerns listed in 1873, each year in which a withdrawal was recorded obviously had a mortality rate in excess of the annual rate. But, there were thirty-seven years in which no withdrawal was recorded.^E Also, only one withdrawal per year was recorded in twenty different years. But, the years of 1874, 1877, and 1900 had mortality rates of 14.28, 11.07, and 6.35 per cent respectively.^F Most of the concerns recorded as exits in 1874 and in 1877 were harness, saddle, and trunk manufacturers which were established between 1867 and 1873. Their withdrawal within one to ten years from the date of their establishment would normally be expected, but the mortality rate for 1900 was not normal nor could any satisfactory explanation be discovered.

METALS.

IRON AND STEEL AND THEIR PRODUCTS

There were 124 manufacturing concerns in the 1856 directory for Pittsburgh and surrounding cities classified as manufacturers of iron

and steel and their products. They ranged in age from one to fifty-five years.^A Only one, or less than 1 per cent, of the total number of concerns was over fifty years of age. Of the firms listed, 10.5 per cent had existed for at least twenty-six years, 48.4 per cent for at least ten years, and approximately 21 per cent were in their first year of life.^B Their median age of 9.4 years was two years higher than the median of all manufacturing concerns listed in 1856.

In 1873 there were 206 firms in the iron and steel group. Their ages ranged from one to seventy-two years.^C In this year, 2.4 per cent of the iron and steel manufacturers were at least fifty years old, 19.9 per cent were at least twenty-six, and 51 per cent were at least ten years of age. Approximately 10 per cent were in their first year of development.^D Their median age of 10.15 years was 3.15 years higher than that of all manufacturing concerns listed in 1873.

By 1947, there were twelve concerns in the iron and steel group which had survived the 1873-1947 period. Their ages ranged from 79 to 146 years.^J Three had existed more than one hundred years, and the oldest manufacturer in Allegheny County was in this group. Fifty per cent of the concerns were at least ninety-two years of age, which was the same as the record established by all manufacturing firms surviving to 1947.

The median age for the concerns in the iron and steel group varied with the period used in the computation. The 1873-1947, 1856-1947, and 1793-1947 periods showed a median length of life of 18.0,^G 6.0^H, and 7.66^I years respectively. In each period, the median age of the iron and steel group exceeded the median age of all manufacturing concerns. Percentagewise, the greatest difference occurred in the 1793-1947 period. This condition largely resulted from the relatively high percentage of prominent iron manufacturing firms which existed within the 1793-1856 period.

A ratio of 17.2 to 1 exists between the number of concerns in the iron and steel group in 1873 and the number continuing to 1947. A comparison of the number of firms listed in 1856 with the number which survived to 1947 results in a ratio of 20.7 to 1. Of the 320 concerns which commenced operations between 1856 and 1873, six lasted to 1947 to produce a ratio of 54 to 1. And, of the 444 iron and steel manufacturers which operated within the 1856-1873 period, one of every thirty-seven survived to 1947. In each of these four survival ratios, the iron and steel group demonstrates a decidedly better survival ability than does the average of all manufacturing concerns.

The 206 concerns in the iron and steel group in 1873 represented a 65

per cent increase over the number listed in 1856, whereas, the average increase in the number of all manufacturers was 90 per cent. Since the rate of increase in the iron and steel group was considerably lower than the average rate of increase, and the median age and survival ratios were much better than the average for all manufacturing concerns, it would appear that the survivors in the iron and steel group benefited from the low rate of growth in the industry. This slow growth resulted chiefly from the financial difficulty encountered in establishing a concern in this field since the nature of iron and steel manufacturing plants requires a substantial initial capital outlay.

The net increase of eighty-two concerns in the iron and steel group within the 1856-1873 period resulted from 320 entrances and 238 withdrawals.^N The median entrance rate of 10.1 per cent was 5.2 per cent below that of all manufacturing concerns. The median mortality rate of 8.1 per cent was 3.1 per cent below the average mortality rate of all manufacturers. Both the mortality and entrance rates of this group are exceptionally low when compared with any other manufacturing group. It appears that prospective concerns failed to enter the iron and steel industry for some reason other than fear of a high mortality rate. Also, it seems that those which did enter the industry were well prepared to resist failure, or that the nature of concerns in the iron and steel group was most favorable toward continued existence.

By 1947, 94.2^E per cent of the firms which were in the iron and steel group in 1873 had discontinued operations. The equal allocation of the gross mortality rate throughout the 1873-1947 period gives an annual mortality rate of 1.27 per cent. This rate was exceeded in twenty-four different years, but no withdrawals were recorded for nineteen years. There was only one withdrawal in each of sixteen years and only two per year for fifteen years. The three highest mortality rates were 6.3, 7.3, and 5.3 per cent for 1874, 1875 and 1877 respectively.^F Most of the concerns recorded as withdrawals in these three years had been listed among the seventy-six entrances in 1871, 1872 and 1873. Consequently, it is to be noted that it was not unusual for many iron and steel manufacturers to withdraw within a few years after they had begun operations.

When consideration is given to the mortality rate computed from the number of concerns existing in the year immediately preceding the year in which a withdrawal was recorded, high mortality rates result for 1900, 1901, 1930, and 1940. An investigation into the conditions contributing to these abnormal mortality rates reveals that the 1900 rate

included the withdrawal of five concerns which had merged into a new firm and that the 1901 rate included eight which entered another merger. Otherwise, the withdrawals recorded for these two years are not unusually excessive. No acceptable explanation could be discovered for the 1930 mortality rate, so the withdrawals were assumed to represent concerns which failed. But, the 1940 mortality rate could be reduced below an abnormal percentage if the reorganization of concerns under section 77B of the National Bankruptcy Act would not constitute a withdrawal so long as the business continued to operate under the trustee.

Mergers and consolidations materially increased the withdrawals in the iron and steel group. At least 25 of the 194 withdrawals within the 1873-1947 period were attributed to these, and the tendency toward mergers and consolidations was particularly strong during the 1899-1901 period. In 1900 the Pittsburgh Stove and Range merger accounted for the withdrawal of Anshutz-Bradberry and Company; D. De Haven and Son; Graff and Hugus; Payne, Lee and Company; and A. Bradley and Company.⁴ Eight firms were recorded as withdrawals in 1901 after they became subsidiaries of Crucible Steel Company of America. They were Hussey, Howe and Company; Miller, Barr and Parkin; Anderson, Cook and Company; Crescent Steel Company; Hussey, Wells and Company; Park Brothers and Company; Singer, Nimick and Company; and Smith, Sutton and Company.⁵

The group manufacturing iron and steel and their products include twelve concerns which survived until 1947. These are A. M. Byers Company, Incorporated;^{U4} Hubbard and Company, Incorporated;^{U5} Iron City Tool Works, Incorporated;^{U6} Jones and Laughlin Steel Corporation;^{U7} The Klein-Logan Company, Incorporated;^{U8} Mackintosh-Hemphill Company, Incorporated;^{U9} Marshall Elevator Company, Incorporated;^{U10} R. Monroe and Sons Manufacturing Corporation;^{U11} Oliver Iron and Steel Corporation;^{U12} Rieger Iron and Wire Works, Incorporated;^{U13} Scaife Company, Incorporated;^{U14} and Westinghouse Air Brake Company, Incorporated.^{U15}

No relationship could be established between the rate of growth of the surviving firms and their longevity. Apparently, rate of growth and tangible asset size have had inconsequential effect on the survival ability of concerns in the iron and steel group. With the exception of Westing-

⁴ *Pittsburgh's Business Proclamation of the Pittsburgh Index*, The Index Company, Pittsburgh, p. 67 (1903).

⁵ *Moody's Manual of Investments, Industrial Securities*, Moody's Investors Service, New York, p. 2807 (1947).

house Air Brake Company all of the survivors began with less than \$25,000 of invested capital. In fact, most did not have an original invested capital in excess of \$10,000. Yet, in 1947 the surviving concerns held net tangible assets ranging from less than \$25,000 to over \$200,000,-000. Table VIII shows a comparison of each company's age with its net tangible asset class.

TABLE VIII
AGE AND ASSET SIZE CLASS OF MANUFACTURING
CONCERNS SURVIVING TO 1947

<i>Asset Size Class</i>	<i>Number of Concerns in Class</i>	<i>Years Concerns Have Existed</i>
\$200,000,000 and over	1	96
50,000,000—74,999,999	1	79
10,000,000—24,999,999	2	84 and 102
5,000,000— 9,999,999	1	87
1,000,000— 4,999,999	2	92 and 146
250,000— 499,999	2	81 and 92
100,000— 249,999	2	92 and 130
10,000— 24,999	1	80

It is difficult to develop any valid correlation between the date of birth and survival ability of the various firms in the iron and steel group. There are instances of a firm's beginning a specific type of manufacture at a particularly opportune time; but the iron and steel group embraces many different types of manufacturing industries which offered opportunities to new concerns at various times. It is significant, however, that of the forty-two concerns which originated within the 1821 to 1845 period and were included in the 126 firms listed in 1856, none survived to 1947.⁷ On the other hand, two that started between 1802 and 1820 and 28 which began between 1846 and 1870 were able to survive to 1947. Consequently, firms originating in the 1802-1820 period or the 1846-1870 period demonstrated greater survival ability than did those founded between 1821 and 1845.

All twelve concerns classified in the iron and steel group recognize benefits derived from their location. It has provided them with proximity to their raw materials, sales markets, power, labor, and transportation. All of them have found the location advantageous throughout the major part of their existence, and most have profited from it throughout their entire existences. But, a few have not felt, during recent years, that their location is unsurpassed in advantages.

Each of the concerns classified in the iron and steel group, at one time or another, has been confronted with an undeveloped demand. In most, the undeveloped demand existed at the time the concern was founded; in others, the introduction of new products, metals or uses for old products, created a vast undeveloped demand. Although the demand for iron and steel products has varied, the overall demand for iron and steel products has been relatively stable and has, in the long run, greatly expanded. Most concerns in this group have considered their demand to be rather inelastic.

A favorable location, market demand, advantageous transportation facilities, availability of economical power, proximity to abundant raw materials, adequacy of economical labor, and origin within an opportune period are factors which undoubtedly contributed to the continued existence of concerns in the iron and steel group. But, manufacturers who discontinued had the benefit of the same factors. Obviously, if the presence of these factors enabled some manufacturers to continue successfully, many concerns which no longer exist should still be in business. The withdrawal of firms which had the advantages listed above limits the valid reasons for continued existence to conditions prevailing within the operations of the survivors.

The specific longevity factors which were associated with the twelve surviving firms are summarized in Table IX. They were taken from the data sheets which list information in the form in which it was originally obtained. No attempt was made to classify the various factors into refined categories. Consequently, there appears to be overlapping in the forty-five different items shown in Table IX. Actually, each represents a distinct contribution to the company's survival. For instance, several of the factors involve the data of origin of companies but each denotes a slightly different condition. One concern was the original producer in its field; another was not the pioneer but was among the first few manufacturers in a given field; and still a third was neither the first producer nor among the earliest but was undoubtedly fortunate in its choice of time of entrance.

Of the forty-five different longevity factors, only "general managerial ability of specific individuals" was associated with all of the survivors. Several of the concerns benefited from the managerial ability of more than one individual, but in each concern there was one person who possessed outstanding managerial ability. Usually, the individual was connected with the firm during its first twenty-five years.

The advantage derived from an established reputation of a trade

style, brand name, or trade mark was the second most frequently listed longevity factor. Of course, this was nonexistent during the infancy of the concerns involved and became effective only after other factors had enabled a concern to survive the critical early period.

The third and fourth most frequently listed factors involved the action or ability of a specific individual. Also, the ninth, tenth, seventeenth, twenty-fourth, twenty-ninth and thirty-ninth concerned particular individuals. In addition, many of the other items mentioned resulted indirectly from the action of a specific person. But, nine of the forty-five factors directly involved the action or ability of a person.

TABLE IX

FACTORS CONTRIBUTING TO THE LONGEVITY OF THE TWELVE
MANUFACTURING CONCERNS IN THE METALS, IRON AND STEEL
AND THEIR PRODUCTS GROUP WHICH SURVIVED TO 1947

<i>Factor</i>	<i>Number of Firms Recognizing Factor</i>	<i>Per cent of Total Firms</i>
General managerial ability of specific individuals.....	12	100
Established reputation of trade styles, brand names, etc.....	11	92
Birth of children within the controlling families.....	10	83
Experience of founders prior to origin of the firm.....	9	75
Product control from patents.....	9	75
Inferiority of competitors' products.....	8	67
Pioneering of new products.....	8	67
Governmental action	7	58
Employment of capable administrators.....	6	50
Intentional training of children in the controlling family for executive positions	6	50
Flexibility permitting rapid adjustment to the production of new products	6	50
Favorable employee relations.....	6	50
Timely origin of the concern.....	5	42
Early entrance into a particular manufacturing field.....	5	42
Adequate financing during early years of operation.....	5	42
Heavy reinvestment of profits.....	5	42
Inventive ability of specific individuals.....	5	42
Early establishment of intensive product research and de- velopment	5	42
Limiting of expansion to a size readily controlled by the personal supervision of members of the controlling family	5	42
Conservative operating policy	5	42
Availability of financing during critical periods.....	4	33
Manufacture of a diversified line of products.....	4	33

When each item is multiplied by the number of times it was mentioned, the various factors were listed 188 times. Table X shows that 54 of the 188 times the factors were listed they directly involved the ability or action of a specific individual.

In Table X the "specific individuals" category includes previous experience of founders, general managerial ability, inventive ability, birth of children in the controlling family and their training, Scotch-Presbyterian influence, employment of capable administrators and owner's connections with customers. "Control" involves dominance over raw material source, fuel supply, and transportation. Also, it includes

TABLE IX (CONTINUED)

FACTORS CONTRIBUTING TO THE LONGEVITY OF THE TWELVE
MANUFACTURING CONCERNS IN THE METALS, IRON AND STEEL
AND THEIR PRODUCTS GROUP WHICH SURVIVED TO 1947

<i>Factor</i>	<i>Number of Firms Recognizing Factor</i>	<i>Per cent of Total Firm</i>
Favorable financing connections	3	25
Conservative Scotch-Presbyterian influence	3	25
Control over fuel supply	3	25
Control over raw materials	3	25
Originating and instituting of new methods of production....	3	25
Pioneer manufacturing in a specific field	2	17
Intention to perpetuate firms because of pride rather than profit	2	17
Control over transportation	2	17
Superiority of production methods over competitors' techniques	2	17
Rapid adoption of new machinery and new methods of production	2	17
Production supervision by specific individuals	2	17
Catering to a particular segment of the sales market	2	17
Periods of ineffective competition or complete absence of competition	2	17
Timeliness of expansion program	2	17
Succeeding original producer in a particular field	1	8
Extension of debt maturity by creditors	1	8
Association of owners with customers	1	8
Inferiority of competitors' services	1	8
Liberal profit-sharing plan	1	8
Acquisition of competitive concerns	1	8
Protection of fire risks	1	8
Marketing methods	1	8
Introduction to new methods of distribution	1	8

TABLE X
THE DISTRIBUTION, BY MAJOR CATEGORIES, OF THE NUMBER
OF TIMES LONGEVITY FACTORS WERE ASSOCIATED WITH
CONCERNS IN THE METALS, IRON AND STEEL GROUP

<i>Major Category</i>	<i>Number of Listings</i>	<i>Per Cent of Total Listings</i>
Specific Individuals	54	28.7
Control (Monopolistic Elements)	28	14.9
The Product	19	10.1
Financing	18	9.6
Production Methods	15	8.0
Time Element—Organization or Expansion	15	8.0
Competition	12	6.4
Operating Policy	10	5.8
Employee Relations	7	3.7
Governmental Action	7	3.7
Marketing Methods	2	1.1
Protection against Risks	1	.5
Total	188	100.5

product control from patents, reputation, trade marks, and brand names. The "product" classification contains intensive product research and development, pioneering new products, diversified line of products, and production for a particular segment of the market. These three categories include over 50 per cent of the longevity factors involved.

Grouped in the "financing" category are adequate financing during infancy, availability of financing in critical periods, heavy reinvestment of profits, favorable financial connections, and extension of debt mortality by creditors. The "time element" grouping includes items involving dates of origin and periods of expansion. Under "competition" are the factors concerning absence of competition, inferiority of competitors' services or products, and acquisition of competitive concerns.

Conservative operating policy and expansion limited to a size readily controlled by the personal supervision of members of the controlling family comprise the "operating policy" category.

Some of the factors are placed, more or less, arbitrarily in a specific category. In some cases, the same factor could be classified in more than one category. But such a distribution would result in the same factor's being counted twice. Even if the factors comprising the first seven categories were reclassified, they would be transferred to another class included among the same seven categories. Consequently, these cate-

gories involving "specific individual," "product and methods of production," "financing," "competition," and "control" would still contain over 85 per cent of the number of times various factors were listed. It appears that the items comprising these categories represent the most important reasons for the continued existence of the concerns involved; and since most of these factors involve a specific individual or the indirect influence of management, managerial action and ability logically dominate as contributors to the longevity of the surviving concerns.

METALS, NONFERROUS AND THEIR PRODUCTS

The group manufacturing nonferrous metals and their products, in 1856, included thirty-four concerns. Their ages ranged from one to forty-four years.^A Fifty per cent of them were at least eight years old, whereas, the median age of all manufacturing firms was 7.4 years.^B Although four manufacturing groups had a higher median age, the age of the upper quartile of firms in the nonferrous metals group was exceeded only by the group manufacturing leather and its products.

In 1873, 49.5 per cent of the firms in the nonferrous metals' group were at least seven years of age as compared with 49.8 per cent for all manufacturing concerns.^D Not only had the median age of the nonferrous metals' firms decreased, but this group had changed from an above average to a below average age group. The change largely reflected the displacement of firms in the group by concerns classified under the heading "Metals, Iron and Steel." This condition resulted from the substitution of iron and steel in products previously made of nonferrous metals.

By 1947 the median age of the surviving concerns in the nonferrous metals' group was 110 years in contrast to the fact that 50 per cent of all surviving manufacturing firms were less than 92 years of age.^J Moreover, 80 per cent of the firms in this classification were more than 100 years of age.

The previous three comparisons of the median ages of the concerns in this group with the ages of all manufacturing concerns in 1856, 1873, and 1947 show the nonferrous metals' group with an above average age in 1856, below average age in 1873, and the highest average age in 1947. These comparisons reflect the exit of several well established firms between 1856-1873 and the concurrent fortification in the conditions of the old established firms during the same period. So effective was this condition that 50 per cent of those concerns which were at least twenty-five years of age in 1873 survived to 1947.

The median age obtained by the concerns in the nonferrous metals' group varied according to the period included in the computation. The three periods of 1873-1947, 1856-1947, and 1793-1947 showed a median length of life of 16.1,^g 6.7,^h and 9.1ⁱ years respectively. In each instance, the average age reached by this group exceeded the median age obtained by all manufacturing concerns. Percentagewise, the greatest difference occurred in the 1793-1947 period, which indicates that prior to 1856 nonferrous metal manufacturers were living longer than all other manufacturing concerns, but lost that favorable position subsequent to that date.

Ninety-five firms were classified in the nonferrous metals' group in 1873. This number represented a 179.4 per cent increase over the thirty-four firms listed in 1856, while the average increase for all manufacturing concerns was only 90 per cent. The net increase of sixty-one resulted from 155 entrances as against ninety-four exits during the 1856-1873 period.^o The median birth rate was 5.9 per cent in contrast to 11.2 per cent for all manufacturing concerns. The high birth rate combined with the low mortality rate to make the nonferrous metals the second fastest growing group, according to percentage, of all manufacturing groups during the 1856-1873 period. It was exceeded only by the rate of growth in the petroleum group.^p

A ratio of 19 to 1 exists between the number of nonferrous metal concerns listed in 1873 and those which survived to 1947, and 8.5 to 1 is the ratio between those existing in 1856 and the concerns surviving to 1947. Of the 155 firms which entered business between 1856 and 1873, only one continued to 1947. And, of the 184 which operated from 1856 to 1873, one out of every 36.8 firms survived to 1947. In each of these four ratios, the nonferrous metals' group presents a decidedly better survival ability than does the average of all manufacturing concerns.

The effect of mergers and consolidations in the nonferrous metals' group was almost negligible. Unlike the chemical and iron and steel groups in which a high percentage of long established firms were listed as exits because of mergers and consolidations, only one old firm left the nonferrous metal group under such circumstances. But, a heavy toll was exacted by firms' discontinuing their manufacturing operations to continue activities as wholesalers or dealers. This practice was especially prevalent during the period from 1880 to 1903 when nineteen of the fifty-one concerns listed as exits, actually carried on business as dealers or wholesalers.

Of the nonferrous metal concerns which existed in 1873, 94.7 per cent^q

had discontinued business by 1947. The equal allocation of this gross mortality rate over the 1873-1947 period gives an annual mortality rate of 1.28 per cent. This rate was exceeded in twenty-two of the years involved. But, a mortality rate of zero was recorded for thirty-eight different years, and a yearly rate of 1.1 per cent was found for an additional thirteen years.^F The highest mortality rate, 5.3 per cent, was recorded for 1882 and 1886. In each of these years, the rate was increased by a firm's substituting wholesale activities for manufacturing.

When consideration is given to a mortality rate based on the number of firms existing in the year immediately preceding the year in which a withdrawal was recorded, the largest mortality rates are seen in 1904, 1911, 1932, 1938, and 1939.^F The mortality rate in 1904 and 1911 was increased by firms transferring to wholesaling activity. In 1932 the rate was raised by C. G. Hussey and Company's becoming a subsidiary of Copper Range Company.⁶ The 1938 rate was increased when McKenna Brass and Manufacturing Company, Incorporated, moved out of Allegheny County and the 1939 rate was inflated by Bailey-Farrell Manufacturing Company's changing to wholesale activities.⁷

One reason for computing the annual mortality rates was to determine which period severely tested the survival ability of a concern. The factors which enabled a surviving concern successfully to overcome the critical periods should represent valid explanations of longevity. But, as it developed in the computation of mortality rates for other manufacturing divisions, the annual mortality rates for the nonferrous metals' group, after necessary adjustment, failed to disclose periods which were related to the critical periods experienced by the surviving concerns.

The group manufacturing nonferrous metals and their products included five concerns which survived to 1947. These are A. W. Cadman Manufacturing Company, Incorporated;^{U16} Chaplin Fulton Manufacturing Co. (Inc.);^{U17} Collins & Wright, Inc.;^{U18} Kincaid Brothers;^{U19} and Trantor Manufacturing Company (Inc.).^{U20} Four of these five survivors were established during the 1832-1839 period. Three other nonferrous manufacturing concerns which originated in the same period survived to 1882, 1886, and 1907. The seven manufacturers included in these two groups represented the majority of concerns in the nonferrous

⁶ Copper Range Company acquired control of C. G. Hussey & Co., Inc., in 1931. In 1936 C. G. Hussey & Co., Inc., became a wholly owned subsidiary of Copper Range Co.

⁷ Bailey-Farrell Manufacturing Company reorganized under section 77B of the National Bankruptcy Act in 1938. Consequently, even if it had continued manufacturing activities, its survival would be questionable.

metals' category whose birth during the 1832-1839 period was substantiated. Their unusual survival records indicate that the period from 1832 to 1839 was favorable for the origin of firms in this group.

The early history of four of the concerns in this group was closely connected with river transportation. Three of the firms once operated brass foundries from which they obtained the raw material for manufacturing products for river craft. But as the demand declined with decreased river traffic, the four gradually began to manufacture different commodities. Today, only one concern continues to operate a brass foundry, and each of the four firms, although still producing products from nonferrous metals, is manufacturing different products which enter separate sales markets.

Little similarity exists between these concerns as to asset size reached by 1947. It does appear, however, that there has been a tendency toward small size operation. According to asset size, they are grouped into five separate classes: \$10,000-\$25,000, \$25,000-\$50,000, \$50,000-\$100,000, \$100,000-\$250,000, and \$1,000,000-\$5,000,000. Three of the five have a net worth below \$100,000 and only one has a net worth in excess of \$1,000,000. It would be incorrect to conclude that nonferrous metal manufacturers are usually small concerns, but the conclusion that the small manufacturers in this group have most successfully resisted failure, merger, consolidation, or succession is substantially correct.

All five of the concerns in this group have found their locations favorable. Their locations have provided proximity to raw materials, power, labor, and sales market. Chaplin Fulton Manufacturing Company, however, has not recognized any particular advantages in its location during the past twenty years. None of these firms considers its location as being as advantageous today as it was in previous years because of changes both in sources of supply and market.

The demand for the products of these five concerns has expanded and then decreased. Kincaid Brothers has continued producing substantially the same products while experiencing a declining demand. The other four concerns have introduced new items when the demand for their old ones decreased. Consequently, these four firms have repeatedly adopted new products or new variations of the old products.

Numerous reasons were advanced as factors contributing to the longevity of these firms. The following table (Table XI) lists the various longevity factors found and the number of concerns recognizing each factor. All five firms believed that the birth of children within the controlling family who were willing and capable to continue success-

fully the business represented a longevity factor. Also, recognized by all were the advantages derived from an established reputation and the control over sales market from patents. Eighty per cent specified general administrative ability of a particular individual, 60 per cent included inventive ability of specific individuals, and the previous experience of the founders, as contributors to longevity. Also, 60 per cent recognized the superiority of product and the flexibility in the organiza-

TABLE XI

FACTORS CONTRIBUTING TO THE LONGEVITY OF THE FIVE
MANUFACTURING CONCERNS IN THE METALS, NONFERROUS
GROUP, WHICH SURVIVED TO 1947

<i>Factor</i>	<i>Number of Firms Recognizing Factor</i>
Birth of children in controlling family willing and capable to continue firm	5
Established reputation	5
Control of markets—from patents.....	5
Managerial ability—specific persons	4
Previous experience of founders.....	3
Inventive ability—specific persons	3
Flexibility permitting rapid adjustment to the production of new products	3
Superiority of product quality	3
Original manufacturers in its field in Allegheny County.....	2
Favorable financing during infancy	2
Owners' connections with sales market.....	2
Availability of financing during critical period.....	2
Employment of capable administrators.....	2
Superior knowledge of sales market by specific individuals.....	2
Size of concern limited to available supervision.....	2
Conservative operating policy	2
Control over raw material	2
Control over fuel supply	1
Price, territory or product agreement.....	1
Highly standardized production methods	1
Superiority of production methods	1
Periods of ineffective competition	1
Intentional training of children in controlling family for executive positions	1
Reinvestment of profits	1
Early entrance into industry	1
Experience previously acquired by individuals entering business sub- sequent to date of origin	1

tion which permitted rapid adjustment to the production of new products. Four of the eight most frequently mentioned longevity factors involved a specific individual; two concerned the product, and two combined the product with the action of a specific person. But, actually each of the eight most frequently mentioned factors either directly or indirectly involved some specific individual's characteristics or his activity.

PETROLEUM, COKE AND ALLIED INDUSTRIES

Since the refining of oil did not begin until 1859, there were no petroleum refineries listed for Allegheny County in the 1856 business directory.⁸ There was, however, one concern listed which engaged in the manufacture of a patent medicine similar to "Seneca" or "British Oil." The medicine was later labeled "Kiers Petroleum and Rock Oil." It was made by skimming the surface of water with blankets to absorb the oil. Then, after the oil was submitted to a so-called refining process, it was sold as a remedy for bruises, burns, rheumatism, and sprains. By 1856 the producer of this oil product had been in business for eleven years.⁹

Coke, however, was being produced at the Allegheny furnace in Blair County⁹ as early as 1811, but the 1856 business directory failed to show any coke production for Allegheny County.

There were thirty-seven firms in the petroleum and coke group in 1873.¹⁰ Their median age was 5.87 years. Only 16.3 per cent of these firms was more than ten years old,¹⁰ and only one had been listed in the directories for the previous fifteen years. Nearly 75 per cent of the manufacturers had entered business subsequent to 1863. That condition was a result of the then recent origin of the petroleum industry and not of the rapid turnover of concerns engaged in petroleum production.¹⁰

None of the firms classified in the petroleum and coke group in 1873 continued to operate until 1947. One remained in business until 1896, another until 1902, and a third did not disappear from the business directories until 1906.¹¹ But, over 60 per cent of the manufacturers in this group failed to survive in 1880. In fact, after 1877 this group had the poorest survival record of all the manufacturing groups tabulated in 1873.

The 1873-1947,¹² 1856-1947¹³ and 1793-1947¹⁴ periods showed a median

⁸ Thurston, George H., *Pittsburgh's Progress, Industries and Resources*, p. 187.

⁹ *Ibid.*

¹⁰ Emphasis is placed on oil refining concerns because 81 per cent of the total firms involved were engaged in oil refining.

length of life of 7.1, 3.55, and 3.55 years respectively in the petroleum and coke producers. The identical median age for the last two periods resulted from only one concern's being included in the last period which was not recorded in the second period. In comparison with other manufacturing groups, the median age of the petroleum and coke group was lowest in the first and third periods and next to the lowest in the second period. Its poorest performance was during the first of the three periods.

From one concern in 1856, the number of firms in the petroleum group increased to thirty-seven in 1873. The percentage of increase substantially exceeded the percentage increase of the number of firms engaged in all fields of manufacturing activity as well as the percentage increase in any single manufacturing group. Obviously, this condition was largely due to the fact that only one firm was classified in the petroleum group in 1856.

One hundred and six manufacturers in the petroleum and coke group began functioning between 1856 and 1873. Seventy discontinued operations during the same period. More new concerns were recorded for 1862 than for any other year, while 1872 led all other years in the number of firms which left the field. The median rate of annual entrances was 28.2 per cent, and the median annual mortality rate was 16.7 per cent. In both cases, these annual rates considerably exceeded the median rates for all manufacturing concerns. Altogether, this period reflected wild fluctuations among the number of concerns classified in the petroleum group.^P

After 1873, several withdrawals from the petroleum group were recorded because of mergers, sales, and consolidations. The Standard Oil Company was a great factor in the elimination of independent oil refineries. Unlike the other manufacturing groups, not a single case of a firm's transferring from manufacturing to trading activity was discovered among petroleum producers.

Of the firms classified in the petroleum and coke group none continued operations after 1905. An equal allocation of the gross mortality percentage throughout the 1874-1906 period showed an annual mortality rate of 3.33 per cent. That rate was exceeded in six of the seven years from 1874 through 1880.^F So heavy was the mortality during that period that only 37.8 per cent of the firms functioning in 1873 were still in operation in 1880. Between 1881 and 1906, however, there were only three years in which as many as two concerns were listed as withdrawals.

Approximately 85.0 per cent of the firms included in the petroleum and coke group were engaged in the refining of oil, accounting for ninety-

one of the 107 concerns in the classification.^E Since the refining of oil originated during the 1856-1873 period, the entrances, longevity, and withdrawals of concerns in the petroleum group furnished a reasonably valid gauge of the origin, development, turnover, withdrawal, and the stability of enterprises in this new industry.

PRINTING AND ALLIED INDUSTRIES

In 1856 the ages of the thirty-five concerns engaged in printing and allied industries ranged from one to forty-five years.^A Of this group, 37.1 per cent were in their first year of existence.^B Forty per cent were at least eleven years of age, and 20 per cent had existed for eighteen years or longer. Their median age of 9.2 years exceeded the median age of all manufacturing concerns by 1.8 years, and it was the third highest among the various manufacturing divisions.

By 1873 only eleven of the thirty-five firms which were operating in 1856 were still in existence.^C Nevertheless, there were fifty-three classified in the printing and allied industries division. Their ages ranged from one to sixty-two years, 15.1 per cent of them having been established in 1871, 13.2 per cent in 1870, and 11.3 per cent in 1872.^D Only 7.6 per cent had begun business in 1873. Their median age of 5.4 years was 1.6 years below the median age of all manufacturers. Consequently, during the 1856 to 1873 period, this division had changed from an above average to a below average age group.

Of the concerns classified in the printing and allied industries' division in 1873, three survived to 1947. The ages of the survivors ranged from 77 to 130 years.^J Their median age was the same as the median age of all manufacturing concerns. Peculiarly, this group included one of the two youngest firms, one of the three oldest, and one firm with an age equal to the median age of all manufacturing concerns. No other manufacturing group included survivors whose dates of origin were so widely separated.

The median age determined for concerns classified in the printing and allied industries' division varied with the period included in the computation. A median age of 5.5,^I 4.2,^H and 9.5^G years was computed for the 1793-1947, 1856-1947, and 1873-1947 periods, respectively. In comparison with the median ages for all manufacturing concerns the printing and allied industries' group was above average in the first period and below average in the second and third periods. In fact, only the petroleum group had a median age below 9.5 years from 1873 to 1947.

The fifty-three firms in the printing and allied industries' group in 1873 represented a 51 per cent increase over the number in this division in 1856, whereas, the average increase in the number of all manufacturers was 90 per cent. Except for the food group, all of the manufacturing divisions increased their number by more than 51 per cent during the same period. In light of the restriction placed on entrances into the food group,¹¹ the printing and allied industries' division had the poorest rate of growth of any manufacturing group during the time from 1856 to 1873.

Throughout the 1856-1873 period, ninety-one entrances were recorded in the printing and allied industries' division.⁹ Seventy-three concerns withdrew, leaving a net increase of eighteen. The median entrance rate of 17.9 per cent was 2.6 per cent higher than the median rate computed for all manufacturers. The median mortality rate of 13.2 per cent was 2.0 higher than the median mortality rate of all manufacturing concerns. A comparison of the higher entrance rate with the higher mortality rate indicates that the printing group should have experienced a more favorable growth, but the median does not express the variations from the median which were unfavorable to an increase in the number of concerns.

A ratio of 17.7 to 1 exists between the number of concerns classified in the printing and allied industries' group in 1873 and those which survived to 1947, and 17.5 to 1 is the ratio between the firms in this group in 1856 and the number which survived to 1947. Of the ninety-one which commenced operations between 1856 and 1873, only one survived to 1947. And, of the 126 of these concerns which operated within the 1856-1873 period, one of every forty-two survived to 1947. In each of these four ratios, the printing and allied industries' division shows a decidedly better survival ability than does the average of all manufacturers.

A contradiction seems to exist between the conclusions drawn from comparing the survival ratio of concerns in the printing group with all manufacturers and the median age obtained by firms in the printing group with all manufacturing concerns. But, actually, there is no contradiction. The comparison of the median ages indicates that the average firm in the printing division did not live as long as the average of all manufacturers. And, the comparison of the survival ratios indicates that it took a smaller number of businesses in the printing division to pro-

¹¹ See p. 64, Food Section.

duce a survivor in 1947 than it did among all manufacturing concerns.

Almost all of the withdrawals from printing and allied industries were caused by failure or a complete severance of continuity by sale to buyers who were not previously connected with the businesses. The effect of mergers, consolidations, and transfers from manufacturing to trading activities was unimportant. Of course, there may have been instances which were not detected because of the methods employed in this study. Nevertheless, if such instances did exist they were minimized to the extent that their number was not significant.

In the printing and allied industries' division 94.3^E per cent of the concerns which existed in 1873 had discontinued by 1947. The equal distribution of the gross mortality rate throughout the 1873-1947 period gives an annual mortality rate of 1.27 per cent. Because of the small number of firms involved, the withdrawal of only one produced a mortality rate in excess of the equal annual rate.^F No withdrawals were recorded in forty-seven years, however, and only one was recorded in each of seventeen years. The three highest mortality rates were 9.4, 9.4, and 11.3 per cent for 1874, 1875, and 1877, respectively. These three years also had the highest mortality rates for the average of all manufacturing groups. Consequently, nothing of an abnormal nature could be detected in the 1874, 1875, and 1877 mortality rates for concerns in printing and allied industries.

When consideration is given to a mortality rate based on the number of firms existing in the year immediately preceding the year in which a withdrawal was recorded, the largest mortality rate is shown in 1934. Two of the six firms listed in 1933 were recorded as withdrawals in 1934. They were E. F. Anderson and Company, founded in 1826, and James McMillan Printing Company, established in 1851. Both were engaged in book and job printing activities. The loss of these 88 and 108 year old concerns substantially reduced the survival record in the printing and allied industries' division.

Three of the fifty-three firms operating printing and allied industries in 1873 survived to 1947.^E They were William G. Johnston Company, Incorporated;^{U21} Bunting Stamp Company, Incorporated;^{U22} and James H. Matthews and Company, Incorporated.^{U23}

James H. Matthews and Company was the pioneer in Allegheny County in the manufacture of stencils, stamps, and marking devices. Bunting Stamp Company was the second to manufacture such products. In fact, no other Allegheny County concern manufactured similar items during the 1850-1873 period. Consequently, those engaged in

stencil and stamp manufacturing demonstrated 100 per cent survival ability. Only the hardware manufacturing concerns in the iron and steel group showed a comparable record of survival ability.

William G. Johnston Company, the third survivor, originated in 1818 as an outgrowth of a job printing establishment which was founded in 1800 by Zadok Cramer. Gradually this concern added engraving, lithographing, and book binding to its activities. Unlike the stencil and stamp concerns, this company encountered heavy competition prior to 1874, since more than 120 competitors operated during the 1856-1873 period. Several other competitors discontinued operations prior to 1856.

There does not appear to be any relationship between growth and survival ability in the three surviving concerns. All began with a small amount of capital. After 130 years of activity, W. G. Johnston and Company should be classified in the \$250,000-\$500,000 asset size class; after 77 years the Bunting Stamp Company falls in the \$25,000-\$50,000 asset size class; and after ninety-seven years, James H. Matthews and Company has net assets in excess of \$1,000,000.

There has been much similarity in sales markets catered to by the surviving firms. For each, most of its distribution has been to industrial concerns; and municipalities, utilities, wholesalers, and retailers comprise the major part of the remaining market. It appears that the concentration of sales among industrial concerns located in a highly industrialized area represents a general factor contributing to the longevity of the survivors.

Another longevity factor of a general nature has been the absence of detrimental seasonal operations. Each of the surviving concerns has experienced comparatively steady operations throughout the year. Consequently, none of them has encountered the "diseconomies" associated with seasonal activity.

All have found their locations favorable. They have had proximity to their major sales market, excellent transportation, adequate power, and an ample labor supply. Neither of the stamp and stencil concerns, however, has considered its location particularly advantageous during the 1920-1947 period because the finished products are sold to fabricators. Since 1920, an increasing number of fabricators have located in the Cleveland-Toledo-Chicago area. Throughout the past 25 years, a stencil, stamp, and marking device concern centrally located between Cleveland and Chicago has had greater proximity to the sales market than one located in Allegheny County. James H. Matthews and Company alleviated this difficulty by establishing a subsidiary in Chicago in 1925.

Throughout their existences these companies have been aided by a favorable demand for their products. Of course, there have been periods when the downward swing of the business cycle temporarily reduced the effective demand. Nevertheless, there has been a gradual expansion in the long term demand for their products. Moreover, they have had a negligible amount of style change in their demand.

TABLE XII
FACTORS CONTRIBUTING TO THE LONGEVITY OF THE THREE
MANUFACTURING CONCERNS IN THE PRINTING AND
ALLIED INDUSTRIES GROUP WHICH SURVIVED
TO 1947

<i>Factor</i>	<i>Number of Firms Recognizing Factor</i>
Previous experience of the founders	3
General managerial ability—specific individuals	3
Birth of children in controlling family willing and capable of continuing the firm	3
Established reputation	3
Emphasis on high quality of service	3
Favorable employee relations	3
Original manufacturer in its field in Allegheny County.....	2
Employment of capable administrators	2
Control provided from patents	2
Conservative operating policy	2
Intentional training of children in controlling family for executive positions	2
Favorable financing during infancy of concern	1
Availability of financing during critical periods.....	1
Favorable financing connections	1
Creditors' extension of debt maturity	1
Superior product	1
Outstanding production supervision	1
Rapid adoption of new machinery and new production methods.....	1
Pioneer with new production methods.....	1
Introduction of new products.....	1
Raw material control	1
Price, territory or product agreement.....	1
Reduction of competition by acquisition of competitive concerns....	1
Favorable political position	1
Securing of government contracts	1
Early entrance into business	1
Timely entrance into business	1
Scotch-Presbyterian influence	1

Such longevity factors as demand, location, and seasonal activity, although helpful, are factors that existed for all concerns operating printing and allied industries. If 125 discontinued, other factors of a specific nature must have enabled the survivors to continue.

The specific longevity factors recognized by officials of the surviving concerns are listed, by the frequency of their occurrence, in Table XII. The listing of a factor does not imply that it has been present constantly; but that it has, at one time or another, been effective.

There appears to be some duplication in the various factors listed in Table XII, but each factor actually represents a different condition. For instance: "favorable financing during infancy" refers to the availability of adequate funds during the formation of the concern, whereas, "availability of financing during critical period" includes conditions which existed subsequent to the formative period when the controlling family supplied necessary financing; and "favorable financing connections" means outside financing which was available during both critical and prosperous periods.

It is significant that three of the six factors which contributed to the longevity of all three firms involved a specific individual. In addition, several others which were recognized by only one or two firms also involved a particular person. Consequently, just as it was with other manufacturing groups, the outstanding longevity factor involved the knowledge, action, or ability of an individual.

A large number of the factors involved the product, production methods, and servicing of the product. All three concerns recognized the value received from the emphasis placed on a high quality of service. Also advantages resulted from offering a superior product, introducing new products, pioneering with new production methods, rapidly adopting new machinery, and supervising production. Consequently, the second most important group of factors is concerned with the product and its manufacture.

The third largest group of factors involved some degree of monopoly control. This group included control of patent and of raw materials, acquisition of competitive concerns, price, territory or product agreement, and the advantages derived from an established reputation.

Several items included financial conditions; others concerned the date the business was established and the advantages derived from political and governmental connections. But, in almost all of the factors there is involved, directly or indirectly, the influence of able management directed by various capable individuals.

STONE, CLAY AND GLASS

In 1856 there were forty-six concerns listed in the directory as manufacturers in the stone, clay, and glass group.^A Their ages ranged from one to forty-nine years. Their median age of 7.6 years was .2 of a year above the median age of all manufacturing concerns listed for that year. Although seven of the ten manufacturing groups had a median age above 7.6 years in 1856, 33.3 per cent of all manufacturing firms which were at least forty-five years of age were classified in the stone, clay, and glass group.^B Moreover, this group was second only to nonferrous metals in the number of firms which were over twenty-six years of age. All of the concerns in this group which were at least twenty-five years of age were engaged in the manufacture of glass.

Glass manufacturing was a very important industry in Allegheny County in 1856. In fact, it had been a leading industry since it was begun in 1795.¹² By 1856, approximately one of every twelve manufacturing concerns located in Allegheny County was engaged in glass production and thirty-six of the forty-eight concerns in the stone, clay, and glass group were glass manufacturers.

By 1873, there were ninety-four concerns^C in this classification. Twenty of them were listed in the 1856 directory and two of these were among the five oldest firms operating in Allegheny County in 1873. The median age of the ninety-four concerns was 6.4 years. Although the median age of all manufacturers was .6 of a year higher, just four manufacturing groups had a higher median age. Only two manufacturing groups contained such a high percentage of firms which were in their twenty-second year of unbroken operations.^D

One concern in the stone, clay, and glass group survived to 1947.^E One continued operating until 1928, another until 1933, and a third disappeared from the directories in 1936. From 1873 through 1896 the survival record of concerns in this group closely paralleled the survival performance of all manufacturers. But after 1896 the similarity disappeared with the concerns in the stone, clay, and glass groups demonstrating increasingly poorer survival ability.

Twenty of the thirty firms which survived to 1947 were over eighty-five years of age.^F The one survivor in the stone, clay, and glass group was in its eighty-third year. Only seven of the thirty surviving concerns had existed for less than eighty-three years. So, in 1947, as in 1856 and

¹² Thurston, George H., *Pittsburgh's Progress, Industry and Resources*, p. 102.

1873, the median age in the stone, clay, and glass group was below the median age of all manufacturing firms included in this study.

The median age of all the concerns classified in the stone, clay, and glass group varied according to the period being considered. For the three periods of 1873-1947, 1856-1947, and 1793-1947, there were computed a median age of 15.0,^G 4.55,^H and 5.66^I years, respectively. In each computation, the median age of the stone, clay, and glass concerns exceeded the median age obtained by all manufacturing firms. Percentagewise, the greatest difference arose in the 1873-1947 period. This condition indicates that after 1873 the stone, clay, and glass manufacturers lived longer in comparison with all manufacturing concerns than they did prior to that date.

A comparison of the number of stone, clay, and glass firms in 1873 with those listed in 1856 reveals an increase of forty-eight concerns. The additional forty-eight represented a 106.3 per cent increase during the period. The average increase for all manufacturing groups was only 90 per cent. The decidedly better percentage of increase in the number of firms classified in the stone, clay, and glass group largely resulted from the relatively large number of entrances recorded for this group in 1872 and 1873. Only the iron and steel group had a larger number of entrances in these two years.

The net increase of forty-eight concerns in the stone, clay, and glass group during the 1856-1873 period resulted from 168 entrances as against 120 exits.^R The median birth rate was 14.9 per cent, which was .4 per cent below the median entrance rate of all manufacturing concerns. The median mortality rate of 11.1 was .1 per cent below the median mortality rate for all manufacturing concerns.^R In all but five of the years involved, the entrances exceeded the withdrawals, and in most instances an increase in the number of entrances in a given year was followed by an increase in the number of withdrawals in the subsequent year.

Between the number of stone, clay, and glass concerns in 1873 and those which survived to 1947 there is a ratio of 94 to 1. Forty-six to 0 is the ratio between the firms listed in 1856 to those which survived to 1947. Of the 168 concerns which entered business between 1856 and 1873 and the 214 which operated from 1856 to 1878, only one survived to 1947. In each of these four ratios, the stone, clay, and glass groups shows decidedly poorer survival ability than does the average of all manufacturing concerns.

Mergers and consolidations accounted for withdrawals in many of

the manufacturing groups; they also account for the withdrawal of 25 per cent of the firms in the stone, clay, and glass group which survived until 1890. But, unlike most of the other manufacturing groups, almost none of the firms in this group ceased manufacturing operations to commence wholesale or jobbing activities.

Approximately 99 per cent of the stone, clay, and glass concerns which existed in 1873 had discontinued operations by 1947.^E However, slightly over 6 per cent of these firms became associated with an enterprise which did survive until 1947. The equal allocation of the gross mortality rate over the 1873-1947 period results in an annual mortality rate of 1.35 per cent. Nineteen of the years involved had a mortality rate in excess of 1.35 per cent.^F But, a mortality rate of zero was recorded for thirty-seven different years and an additional seventeen years had an annual mortality rate of 1.1 per cent.

The highest mortality rate, 9.6 per cent, was shown by the years 1874 and 1877. The 1874 rate was only .7 per cent above the average of all manufacturing groups in that year. And, in view of the entrances recorded for 1873, it was not abnormal. The 1877 rate followed a year in which no exits were recorded. When the withdrawals of these two years are combined, their sum does not exceed the total rate of the withdrawals for the average of all manufacturing groups. It appears, therefore, that the abnormal withdrawal rates computed for these two years are more the result of the technique used than a reflection of the existing conditions.

When consideration is given to a mortality rate computed from the number of firms existing in the year immediately preceding the year in which a withdrawal was recorded, 1892 reveals the highest mortality rate between 1873 and 1902.^F The 1892 rate was exceeded by seven different years after 1902.¹³ A merger accounted for five of the six withdrawals which came in 1892.¹⁴ The United States Glass Company absorbed Adams, Macklin and Company, Doyle and Company, King and Company, Riply and Company, and George Duncan & Sons. Otherwise, the mortality rate for 1892 would have been below the average mortality rate for all manufacturers.

As was the case with other manufacturing groups, the annual mor-

¹³ The high mortality rate for the years of 1903, 1910, 1917, 1920, 1927, 1932 and 1936 primarily resulted from the small number of concerns involved and the method of computation.

¹⁴ White, Edward, *Pittsburgh the Powerful*, The Industry Publishing Company, p. 28 (1907).

tality rates in the stone, clay, and glass group failed to determine critical periods which could be associated with the critical periods experienced by the surviving concern. Consequently, they were useless in determining factors which enabled the surviving concern to overcome successfully critical operating periods.

The concerns classified in the stone, clay, and glass group in 1873¹ included one firm which survived until 1947. It was Harbison-Walker Refractories Company (Inc.),¹²⁴ a fire brick manufacturing concern which was established in 1865 under the trade style of the Star Fire Brick Company. Of the ten other fire brick manufacturers listed in 1873, four withdrew in 1874 and one withdrew in each of the following years: 1878; 1881; 1883; 1908; 1917, and 1932.

Harbison-Walker Refractories Company was classified in the \$25,000,000 and over asset group in 1947. Its tangible net worth was approximately \$30,000,000. Eighty-three years previously the company was established with a capital of \$8,000, but a few months afterwards that was increased to \$16,000. In the first ten years of the existence of the company on a capital of \$16,000 there was returned a net profit of \$72,990.66. Of these earnings, \$20,704.50 were retained in the business to finance the construction of improvements.¹⁵ Thus, was commenced a policy which has never been reversed—the reinvestment of profits in the business.

Since 1865, the company's distribution has been mainly to iron and steel manufacturers, foundries, and manufacturers of glass, chemicals, and coke. Consequently, the company has experienced a negligible fluctuation in the type of company which composes its sales market.

The company has experienced a secular expanding demand. However, since its products are consumed by industries which are highly susceptible to fluctuations of the business cycle, there have been periods of relatively poor effective demand. But, throughout the entire period the company has escaped the frequently disastrous effect of widespread style changes in demand. Those style changes which have occurred resulted more from improvement in the product than from radical changes in the product's nature. It appears that the nature of the demand has been a general factor which contributed to the company's continued existence. Of course, this condition would have been favorable toward all concerns producing similar products in Allegheny County.

¹⁵ Harbison, Samuel P., Letter written by Samuel P. Harbison to his sons quoted in *The Bulletin of the American Ceramic Society*, Vol. 20, No. 6, pp. 210-213 (1941).

The location has been another factor which would have contributed to the longevity of any concern manufacturing an identical product. Any refractory producer would have found that the location provided proximity to the sales market, raw materials, power, transportation, and labor. Consequently, favorable location has not been a factor which was peculiar to the longevity of the surviving concerns.

Several specific factors are associated with the continued existence of the Harbison-Walker Refractory Company. Most of the longevity factors which are identified with this company during the 1865-1904 period are directly or indirectly associated with a specific individual. It was the knowledge, ability, and action of Samuel P. Harbison¹⁶ which largely accounted for the phenomenal growth of this company from a \$16,000 concern in 1865 to one of the world's leading producers of refractory materials in 1901.¹⁷

Of the longevity factors recognized by the company many may be associated with Mr. Harbison. "The experience of the founders"^{U24} refers to the experiences of S. P. Harbison as a school teacher, cashier in the Clerk of Courts office, part owner of Pittsburgh Glass Manufacturing Company, and business manager for Joseph Myers, the Allegheny cattle dealer, who furnished large quantities of beef to the army during the Civil War. "Managerial Guidance"^{U24} refers to the general administrative ability of S. P. Harbison, Hepburn Walker, and S. C. Walker. The friendship between S. P. Harbison and Andrew Carnegie and Mr. Henry Phipps, Jr. was extremely valuable to the company. It was these two men who financed Mr. Harbison's purchase in the Pittsburgh Glass Manufacturing Company. Later, the Phipps, Carnegie, Kloman interests were heavy purchasers of refractory materials. Undoubtedly, this friendship influenced the awarding of the contract for the furnace lining of the first Lucy furnace to the Harbison and Walker Company. The lining lasted for three years and produced 75,000 tons of iron, the largest that had ever been known to that day. Mr. Harbison sent to advertise to the blast furnace trade a testimonial letter written by Thomas M. Carnegie. The letter produced an avalanche of orders and from that time on, the company almost completely dominated the blast furnace lining trade.

¹⁶ The minutes of the Harbison-Walker Refractories Company of May 18, 1904 refer to S. P. Harbison as follows: "His talents were of wide range, and whether used in the business of the company in financial circles, or in benevolent work, the same energy, courage, and firmness of character were manifest."

¹⁷ *The American Manufacturer and Iron World*, "Greater Pittsburgh and Allegheny County," p. 92 (1901).

The fire brick which was produced in 1866 was of very poor quality. Frequently, whole kilns of brick would be turned out and found so defective that it was unsafe to put them on the market. The chief difficulty arose from using clay with a high ore content. For over five years Mr. Harbison experimented with various clays, and finally, major deposits of superior clay, free from iron ore, were discovered in Clarion County.

Contributing to the successful continuation of the Harbison-Walker Company was a conservative operating policy. This policy was inaugurated by S. P. Harbison and reflected his Scotch-Presbyterian influence. With his first earnings, he began keeping a strict account of all expenses, a habit which grew with the years and was carried over into the operation of his company. Therefore, there exist today complete records of the receipts and expenditures for the first ten years of the Harbison-Walker Company's operations.

Many other longevity factors are indirectly connected with Mr. Harbison. The birth of children in his family who were capable and willing to continue operating the business has contributed to the continued existence of the concern. Also, the training given to these children was beneficial. The policy of controlling raw material sources commenced under Mr. Harbison's guidance, and the favorable financing during the infancy and early critical periods of the business can be traced in part to him. Even the advantage received in more recent years from an established reputation has been derived from the operations conducted during the earlier years.

One outstanding factor, aside from the policies of S. P. Harbison, was the firm's timely entrance into the industry. The concern had scarcely been established before the iron and steel industry began the operation of blast furnaces. The production of Bessemer steel in Allegheny County increased very rapidly. Increased production required more blast furnaces which, in turn, multiplied the demand for refractory materials. Consequently, the date of establishment of the Harbison-Walker Company was most timely; five years earlier or later would have been less favorable.

Other longevity factors associated with the Harbison-Walker Company include the managerial guidance supplied by the Harbison and Walker families, the employment of capable administrators, the control of extensive raw material sources, and the acquisition of a large number of subsidiary concerns in the consolidation which was completed

June 30, 1902.¹⁸ Nevertheless, the outstanding longevity factor associated with the Harbison-Walker Company was the managerial influence of Samuel P. Harbison.

WOOD AND ITS PRODUCTS

The 1856 business directory for Pittsburgh and surrounding cities listed sixty-nine concerns which were classified under the title "Wood and Its Products." They ranged in age from one to twenty-six years.^A Only three, or 4.3 per cent of them, had existed for twenty-five years; 5.8 per cent were at least twenty years of age; 29.0 per cent had existed for ten or more years; and slightly more than 40 per cent were in their first year of life.^B Their median age of 3.88 years was 3.5 years below that of all manufacturers listed in 1856 and 1.4 years below the median age of any other manufacturing group.

In 1873, 118 concerns were classified in the group. Their ages ranged from one to forty-two years.^C There were 6.8 per cent at least twenty-five years of age; 38.1 per cent had existed for at least ten years; and approximately 9 per cent were in their first year of life.^D Their median age of 6.25 years was .75 of a year lower than that of all manufacturers listed in 1873. At this time, only five manufacturing groups had a higher median age, whereas, nine had a higher median age in 1856.

In 1947, there were four concerns in the group which had survived the 1873-1947 period. Their ages ranged from eighty to one hundred years.^J One had existed for eighty years, two for eighty-eight years and one for one hundred years. In this group 75 per cent were under the ninety-two year median age of all concerns surviving to 1947.

The median age of the total firms classified in the wood group varied with the periods included in the calculation. The 1873-1947, 1856-1947, and 1793-1947 periods showed a median length of life of 11.3,^G 3.47,^H and 3.85,^I respectively. In each period, the median age was below that of all manufacturers. Percentagewise, the largest variation occurred in the 1873-1947 period; this was because of the large number of concerns that entered the wood group in 1856.

For every 29.5 concerns listed under "Wood and Its Products" in 1873, one survived to 1947. The ratio between the number of firms listed in 1856 and the number which survived to 1947 is 69 to 1. Of the 267 listed as entrances during the 1856-1873 period, three survived to 1947, giving a ratio of 89 to 1. And of the 336 concerns classified in the wood

¹⁸ *Moody's Manual of Investments, Industrial Securities*, pp. 1872-74.

group during the 1856-1873 period, one of every eighty-four survived to 1947. The survival ability demonstrated by the concerns commencing operations during the 1856-1873 period is superior to the survival ability displayed by the average manufacturing concern. But, in the other three ratios, the average manufacturing firm showed superior survival ability.

This group of manufacturers included 118 concerns in 1873. This number represented a 72 per cent increase over the sixty-nine firms listed in 1856, whereas, the average increase in the number of all manufacturing concerns was 90 per cent.

Several factors contributed to the low rate of growth in the wood division. First, there was an increased substitution of iron or steel for wood in the manufacture of numerous products. Second, constantly expanding railroad facilities displaced river transportation, and the building of boats declined. In 1857 there were eighty-four steamers built in Allegheny County, but by 1873, the average number being built each year had dropped to thirty-six.¹⁹ And third, the increased use of railroad transportation retarded the demand for wood in the manufacture of carriages, coaches, and wagons.

The net increase of forty-nine concerns in the group between 1856 and 1873 resulted from 267 entrances and 218 withdrawals.^s The median entrance rate of 18.8 per cent was 3.5 per cent above that of all manufacturing concerns. The median mortality rate of 11.5 per cent was .3 per cent above the average for all manufacturers. The median, however, does not provide a reliable indication of the mortality rates of this group. The sum of the deviations of the mortality rates located above the median greatly exceeded the sum of the deviations falling below it. For instance, the mortality rate for 1872 was 30.5 per cent and in 1860 it was 53.5 per cent.

Of the manufacturers working with wood and its products in 1873, 196.6^E per cent had disappeared from the directories by 1947. The equal division of the gross mortality rate throughout the 1873-1947 period produces an annual mortality rate of 1.32 per cent. In thirty-one of the years involved, the annual mortality rate was exceeded.^F Of the remaining forty-three years, ten had one withdrawal per year, and thirty-three showed no withdrawals at all. Eighteen eighty-four, with 9.3 per cent, and 1887, with 8.5 per cent, were the years having the highest mortality rates. The 1884 mortality rate was .4 per cent below the rate computed for all manufacturers in that year and did not appear to be abnormal.

¹⁹ Thurston, George H., *Pittsburgh and Allegheny in the Centennial Year*, p. 141.

But, the 1887 rate was 1.5 per cent above the average and appeared especially high. An investigation of the reasons contributing to the withdrawal of concerns in that year failed to provide a satisfactory explanation of the high mortality rate. Of course, the investigation was limited by the inadequacy of the information obtainable. Dun & Bradstreet²⁰ reports a sharp increase in the number of commercial failures in that year which explains the mortality rate computed for all manufacturing concerns in this study, but leaves unanswered the reason for the excessively high rate of this group.

Unlike most of the manufacturing groups, the one including wood and its products was almost unaffected by mergers, consolidations, or the substitution of trading activities for manufacturing. With the exception of a few withdrawals of young concerns during the 1856-1873 period and the withdrawal of a thirty-six year old firm in 1900, all exits appeared to result from either failure or sale to previously unrelated buyers. The National Casket Company merger accounted for Hamilton, Algeo, Arnold and Company's being the only withdrawal in 1900.²¹

In 1947 there were four survivors: E. M. Hill Lumber Company,^{U25} Mayer Body Corporation,^{U26} the Schnabel Company,^{U27} and the A. F. Schwerd Manufacturing Company.^{U28} Actually, Mayer Body Corporation and The Schnabel Company could be listed under the title "Iron and Steel and Their Products" in 1947. But, they were originally producers of coaches and carriages and were classified under "Wood and Its Products" for about fifty years. Consequently, for the succeeding twenty-five to thirty years, they have been continued in their original category.

The evidence does not indicate that either the size or rate of expansion of the surviving firms contributed to their survival ability. None of them began operations with a capital investment in excess of a modest five figure amount. Yet, in 1947, one has net tangible assets below \$25,000, two are classified in the \$250,000 to \$500,000 group, and one is in the \$500,000 to \$1,000,000 net tangible asset group. All four are between eighty and one hundred years of age. The oldest has the largest net worth; the second oldest has the smallest, and the youngest has the second largest net worth.

Little relationship can be established between the periods of birth and the survival abilities of the concerns in the group. The Schnabel Company originated at an opportune time; but so did nine of its com-

²⁰ *Commercial Failures in the United States, 1857-1946, Inclusive*, Dun & Bradstreet.

²¹ *Moody's Manual of Investments, Industrial Securities*, p. 190.

petitors who, though founded in the same year, failed to demonstrate unusual survival ability. The date of establishment of the other three firms does not appear to be unusually attractive. Greater opportunities surrounded the origin of many of their competitors who failed. It is significant, however, that although unusual opportunities, in their respective fields, were not present in the year in which three of these four originated, two of the firms commenced operations in 1860, the year of birth for most manufacturers surviving until 1947.¹

All four survivors derived benefits until about 1910 from their locations' providing proximity to raw materials, sales market, power, transportation, and labor. Two still consider their locations advantageous. During the last twenty-five years, one has experienced a steadily decreasing advantage in its location. Today, it does not recognize any benefit in its location and has established more favorably placed subsidiaries elsewhere. Another has found its location to be increasingly disadvantageous during the 1910-1947 period. In fact, this concern has seriously considered relocating closer to the center of its sales market and source of raw materials.

In the early years of their existences the production of the surviving concerns in the wood group was periodically impeded by seasonal operations. Two of the survivors have eliminated this obstruction to their activities, but the remaining two have not been able to overcome seasonal operations. Although comparatively steady production throughout the year is recognized as a beneficial operating condition, it cannot be considered as a factor which definitely contributed to the longevity of these four concerns, since two have not experienced its advantages.

The four survivors have experienced various degrees of demand for their products. All encountered an expanding demand during their first forty to fifty years. Then the demand for wagons and carriages declined, and the two producers involved survived by switching to the production of truck bodies which has provided a long term expanding demand. The effective demand for the products of E. M. Hill Lumber Company, although highly susceptible to the level of business conditions, has experienced a long term expansion. A. F. Schwerdt Manufacturing Company has been confronted with a declining demand at periods during the past forty to forty-five years. It is difficult to state definitely that demand has contributed to the longevity of these four concerns since the various survivors have encountered conflicting types. The firm having the least favorable position today, however, is the one which has experienced a long-term declining demand.

The specific longevity factors which were associated with the four surviving concerns are summarized on Table XIII. Twenty-nine different factors were established as contributing to their longevity. Five were recognized by each survivor; three of these involved the ability or action of a specific individual, one concerned the superior quality of the

TABLE XIII
FACTORS CONTRIBUTING TO THE LONGEVITY OF THE FOUR
MANUFACTURING CONCERNS IN THE WOOD AND ITS
PRODUCTS GROUP WHICH SURVIVED TO 1947

<i>Factor</i>	<i>Number of Firms Recognizing Factor</i>
Managerial ability of specific individuals.....	4
Advantages derived from an established reputation.....	4
Previous experience of the founders.....	4
Birth of children, in the controlling family, willing and capable of continuing the firm	4
Emphasis on the production of a superior product.....	4
Action of the government	3
Financing—availability during critical periods	2
Product control from patents	2
Flexibility in adjusting to the production of new products.....	2
Conservative operating policy	2
Intentional training of children in controlling family to assume execu- tive positions	2
Control over raw material sources.....	2
Prudent financial policy—reinvestment of profits.....	2
Favorable employee relations	2
Production catering to a particular segment of the market.....	2
Originating of new methods of production.....	2
Favorable financing during infancy of business.....	1
Standardization of production methods	1
Flexibility in adjusting to new methods of distribution.....	1
Superiority of production methods	1
Emphasis on quality of service	1
Limiting size of concern for easy supervision by members of the controlling family	1
Favorable financing connections	1
Rapid adoption of new machinery and new methods of production..	1
Protection against fire risks	1
Instituting of measures to counteract seasonal operations.....	1
Pioneering of new products	1
Complete control from basic raw material through finished product..	1
Timeliness of entrance	1

product, and one the advantages derived from an established trade style, brand name, or reputation.

Three concerns associated government action with their survival ability. The receipt of government contracts for war production, W.P.A. requirements, and other government need has aided each of them, at one time or another, to recover from unfavorable operating conditions. All four survivors participated extensively in war production during both World Wars. Three concentrated on war production during the Civil War, and two became securely established during the Civil War period. One was rescued from the most critical time in its history by contracts received for W.P.A. production.

All four concerns have benefited from some phase of financing: two from the availability of financing during critical periods, and two from their financial policies emphasizing heavy reinvestment of profits. One gained from adequate financing during its infancy, and another has been helped by favorable outside financing connections.

The twenty-nine different factors listed in Table XIII were recognized fifty-six times by the four surviving concerns. When these items were grouped into homogeneous categories, factors involving specific individuals were listed fourteen times, as shown in Table XIV. Consequently, 25 per cent of the times factors were recognized, they concerned

TABLE XIV
DISTRIBUTION, BY MAJOR CATEGORIES, OF THE NUMBER
OF TIMES LONGEVITY FACTORS WERE ASSOCIATED
WITH CONCERNS IN THE WOOD AND ITS
PRODUCTS GROUP

<i>Major Category</i>	<i>Number of Listings</i>	<i>Per Cent of Total Listings</i>
Specific individuals	14	25.0
Control (monopolistic elements)	9	16.1
The product	7	12.5
Methods of production	7	12.5
Financing	6	10.7
Operating policy	5	8.9
Government action	3	5.4
Employee relations	2	3.6
Marketing methods	1	1.8
Protection against risks	1	1.8
Time element—organization or expansion	1	1.8
Total	56	100.1

a specific individual's actions or abilities. The "control" category had 16.1 per cent of the listings, 12.5 per cent concerned the product, and 12.5 per cent involved methods of production. These four categories included over 66 per cent of the longevity factors listed.

No matter how the various longevity factors are grouped, most still represent some phase of management or conditions indirectly developing from managerial actions. When the factors indirectly concerning management are added to those of direct management, and they in turn are traced to their source, the continued successful operation of the concerns in this group is largely traceable to the efforts of specific individuals.

NOT ELSEWHERE CLASSIFIED

The ages of the thirty-five concerns included in the group called "Not Elsewhere Classified" in 1856 ranged from one to forty-three years.^A Their median age was 8.3 years, or .7 of a year higher than the median age of all manufacturing concerns. An outstanding feature of this group was that 77.1 per cent were at least four years of age;^B moreover, 62.9 per cent were at least seven years old. Only the chemical group had a comparable record. An unusual situation developed from both the seven year old and the one year old firms' having the same percentage of the total listed in 1856.

The median age of this manufacturing group decreased to 6.93 years in 1873. The decrease placed their median age below that of all manufacturing concerns. Eight firms, however, were over thirty years of age^C in contrast to two in that category in 1856. In addition, in contrast to 1856 a higher percentage of these manufacturers were in their fifteenth, twentieth, twenty-fifth, thirty-fifth, and fortieth years.^D

By 1947 the median age of the two concerns remaining in this group was ninety years in contrast to the ninety-two year median for all surviving concerns.^E

The three previous comparisons of the median ages of the concerns not elsewhere classified with the median ages of all manufacturers in 1856, 1873, and 1947 show that this group had an above median age in 1856 and a below median age in 1873 and in 1947. The favorable position in 1856 resulted largely from the high percentage of long established textile concerns which were included in the computation. Many of them had disappeared by 1873, and only one survived to 1947.

As in other manufacturing groups, the median age of all firms included

in the group not elsewhere classified varied with the period included in the computation. For the 1873–1947, 1856–1947, and 1793–1947 periods these concerns had median ages of 12.5,^G 5.2,^H and 6.1^I years, respectively. Their median age was below the median age of all manufacturing concerns in the first period, but was higher in the last two. Again, conditions in the textile industry influenced these averages.

Sixty-one concerns were classified in this group in 1873. This number represented a 74.3 per cent increase over the thirty-five listed in 1856, whereas, the average increase for all manufacturers was 90 per cent. Only the printing and food groups had a lower percentage of increase during the same period.

The net increase of twenty-six resulted from 102 entrances as against seventy-six withdrawals during the 1856–1873 period.^T The median birth rate was 10.3 per cent, which was 5.0 per cent lower than the rate for all manufacturing concerns. The median mortality rate was 6.5 per cent in contrast to 11.2 for all manufacturers. The birth and mortality rates show that turnover in this group was relatively low. This was particularly true among the textile manufacturers.

A ratio of 30.5 to 1 exists between the number of concerns included in the group in 1873 and the number surviving to 1947. Thirty-five to 1 is the ratio between those existing in 1856 and the concerns which survived to 1947. Of the 102 which entered business between 1856 and 1873, only one survived to 1947. And of the 137 concerns which operated during the 1856–1873 period, one of every 68.5 firms survived to 1947. The ratio for the number entering business between 1856 and 1873 and those which survived to 1947 is slightly lower than the same ratio computed for all manufacturing concerns. But, in each of the other three ratios, the group not classified elsewhere shows a poorer survival ability than the average of all manufacturing concerns.

By 1947, 96.7^E per cent of the concerns which existed in 1873 failed to continue operations. The equal allocation of the 96.7 per cent gross mortality rate over the 1873–1947 period results in an annual mortality rate of 1.3 per cent. Because of the small number of concerns included in this group in 1873, the withdrawal of one constituted a 1.6 per cent mortality rate. Consequently, all of the years, except the thirty-three in which no withdrawals were recorded, had a mortality rate in excess of 1.3 per cent. But, only the first, second, third and eleventh years had mortality rates exceeding 5 per cent.^F

All of the manufacturing groups had high mortality rates for 1874 and 1875. The mortality rates in these two years were increased by the with-

drawals of firms established in 1873. Since entrances of new concerns were not recorded after 1873, mortality rates after 1875 reflected the withdrawal of seasonal establishments only. New establishments have a higher mortality rate than old ones, so it was natural for the group not elsewhere classified to have higher mortality rates in 1874 and 1875.

If there was an economic factor contributing to the excessive rate in 1883, it could not be discovered. Probably, the apparently excessive rate resulted from the method of computation. This assumption is justified by combining the mortality rates for 1882 and 1883. The annual average of the sum of these two rates does not indicate an abnormal period of mortality.

Very few withdrawals in this group could be traced to mergers or consolidations. In addition, only three concerns transferred from manufacturing to retailing activities. Of course, others may have withdrawn because of one or more of the above reasons, but their new identity was not discovered. Consequently, it was assumed that the withdrawals that could not be accounted for resulted from failure or sale to an individual who was not previously connected with the firm.

The two survivors under the heading "Not Elsewhere Classified" were A. Mamaux and Son,^{U29} an awning concern established in 1865, and Wolfe Brush Company, Incorporated,^{U30} a manufacturer of industrial brushes since 1851. Both are in the \$250,000-\$500,000 asset group, but that is about the extent of their similarity. Wolfe Brush Company distributes its products to railroads and industries; A. Mamaux and Son's sales market is composed of department and chain stores and individual consumers. Wolfe Brush Company's business is comparatively steady throughout the year; A. Mamaux and Son has a seasonal business with a peak during April, May, and June.

Since birth both companies have manufactured products which experienced an expanding demand, and the demand has been comparatively steady. Wolfe Brush Company, however, has had the more stable demand.

Location has been favorable to each of the firms. Not only has the location provided proximity to the sales market, transportation, power, and labor; but it has at times isolated them from strong competitors.

There are nineteen specific factors which contributed to their longevity. Each firm recognized eleven specific factors,^{U29, U30} and five longevity factors were claimed by both. The factors recognized and the number of times they were mentioned are shown on Table XV.

Of the five items recognized by both firms, special credit was given

the general administrative ability of specific individuals. Moreover, the other four factors indirectly involved managerial action. The emphasis on a high quality of service stemmed from managerial action, and the superior quality of product combined both managerial action and managerial craftsmanship. In each instance it was the superior craftsmanship of the founders which created a superior product. Once established, the production of a superior product was emphasized in the operation of the business even after the original founder had been succeeded. It was these conditions which later provided the advantages derived from an established reputation. Also, it was the original founders who inaugurated a successful financial policy with frugal living and heavy reinvestment of profits for expansion. Consequently, all five longevity factors, mutually recognized, directly or indirectly involved a particular person.

Most of the longevity factors listed by just one involved the knowl-

TABLE XV
FACTORS CONTRIBUTING TO THE LONGEVITY OF THE TWO
SURVIVING MANUFACTURING CONCERNS IN THE
NOT ELSEWHERE CLASSIFIED GROUP

<i>Factor</i>	<i>Number of Times Recognized</i>
Managerial ability of specific individuals.....	2
Established reputation	2
Emphasis on high quality of service.....	2
Emphasis on superior quality of product.....	2
Prudent financial policy	2
Previous experience of founders.....	1
Birth of children within the controlling family.....	1
Employment of capable administrators.....	1
Conservative operating policy.....	1
Timely entrance into business.....	1
Intentional training of children in the controlling family for execu- tive positions	1
Early entrance into the industry.....	1
Favorable employee relations.....	1
Avoiding competition by producing for a specific segment of the market	1
Insurance protection against fire losses	1
Obtaining government contracts during wars.....	1
Definite intention to perpetuate firm.....	1
Seasonal variation offset by supplementary activities.....	1
Excellent marketing methods.....	1

edge, ability, or action of a specific individual. Management, therefore, appears to be the dominant reason for their continued existence—but there were different types of management involved.

The classification of the longevity factors into distinctive managerial phases should provide a better insight into the survival of these firms; but it is difficult to identify specifically many longevity factors as representing a particular phase of management. At best, such an identification must be somewhat arbitrary.

Four of the factors are of a personal nature and do not exactly constitute a phase of management; they are: previous experience of the founder, birth of children in the controlling family, intentional training of children to occupy executive positions, and the definite intention of the owner to perpetuate the firm. The next largest group of factors involve the administration and include general managerial ability and employment of capable administrators.

Financial management played an important part in the survival of these two manufacturers. It included the reinvestment of profits, conservative expansion policy, insurance protection against fire losses and the protection of working capital with meager withdrawals of assets.

Marketing factors which contributed to their longevity concern procurement of government contracts, employment of effective advertising, and emphasis on a superior quality of service.

Production factors include manufacturing products for a specific segment of the market, a type of specialization, and the manufacture of a superior product. Of course, product specialization and emphasis on superiority of product, along with an established reputation, involve a type of monopolistic control.

Early and timely entrance into the industry are two items which almost defy classification. Both are as likely to be the result of chance as of predetermined decisions. If they resulted from chance, they could not be classified as factors originating from the operations of the concerns; and if they resulted from predetermined decisions, they would represent foresight of a specific individual. As such, they could be said to represent personal factors or administrative ability.

The separation of longevity factors into phases of management, although helpful, does not detract from the importance of specific individuals. On the contrary, it serves to emphasize that particular persons were outstanding contributors to the continued existence of both manufacturers.

ANALYSIS OF THE LEADING LONGEVITY FACTORS

Fourteen different longevity factors were recognized by more than a third of the surviving concerns. Such recognition does not prove that these are the leading determinates of longevity. It merely indicates that they were the most frequently identified apparent causes of continued existence, and it is possible that more valid factors were overlooked. Moreover, the existence of these factors together with those less frequently listed does not guarantee survival. Furthermore, survival could be obtained without the presence of many of these conditions. The fact remains, however, that these were the causes most frequently associated with the survival ability of the concerns involved.

The following analysis of the leading reasons for survival is presented to prevent misconception regarding their nature.

1. *General managerial ability of specific individuals.*

This factor covers managerial ability which was not specifically identified as a separate type of management such as production, sales, or finance; and if an individual's ability was associated with two or more phases of management, it was recorded under this heading. The recognition of this factor does not imply that it has been constantly present but that it was present at some time during the company's history. In fact, some companies that failed had at some time during their operations individuals who possessed outstanding managerial ability. Most of the survivors, however, gave evidence of the presence of this factor throughout all or most of their lives.

2. *Established reputation of trade styles, brand names, etc.*

This comes only after the business has been firmly established because of the working of other factors. But, once effective, it provides extensive benefits. Some surviving concerns have been greatly indebted to the volume of business derived from their reputations. In some cases it has helped maintain capacity operations with minimum advertising expenditures. Some survivors admit that their reputations enable them to charge premium prices for their products in competition with similar ones.

3. *Birth of children within the controlling families willing and capable of successfully continuing the firm.*

The treatment of the second, third, and fourth generations in a concern presented a complex problem. Over 86 per cent of the survivors

recognized that birth of children in the controlling family had contributed to their continuance. Others were discontinued because the owner died without children to replace him. At first it appeared that this factor was a genuine requisite of longevity. Then, it was discovered that many firms, established and successfully operated by owners of ability, failed when taken over by less able members of the family who soon placed the business in financial difficulty. In some instances, proprietors, recognizing the shortcomings of their own children, made provisions for management by administrators outside of the immediate families. Also, cases were discovered of children's rebelling against the rigorous training for executive positions their fathers imposed on them. In spite of the volume of contradictory evidence, survival was almost invariably partly dependent upon the existence of a second, third, or fourth generation which actively participated in the management of the business or employed capable administrators. Consequently, the factor concerning birth of children in the controlling family was qualified by adding: willing and capable of successfully continuing the firm.

4. *Experience of the founders prior to origin of the firm.*

In twenty-five of the thirty surviving concerns, the founders were thoroughly experienced in the type of business they established or had received extensive experience which was readily applicable in the operation of their new establishments. If definite information had been obtainable regarding conditions surrounding the origin of all survivors, this factor would probably have received even greater recognition. Among infant concerns it appears to be significant.

5. *Inferiority of competitors' products.*

This factor was frequently identified as the superior quality of a concern's products. When it applied to products manufactured during the early period of development, it was frequently substantiated by historical references. In many instances the superior product resulted from the craftsmanship of the founder. But, when it applied to more recent products, substantiating evidence was not always available. In fact, two concerns manufacturing almost identical products mentioned the superior quality of their own products, so the recognition of this factor probably included some prejudice as well as fact.

6. *Product control from patents.*

The degree of the control derived from this factor fluctuated greatly with the various concerns and the periods of time involved. It ranged

from a monopolistic position to a competitive position in which numerous substitutes of comparable quality were encountered. Most of the greatest advantages occurred before 1910, but there are a few instances of control from patents still helping a concern to dominate its market.

7. *Favorable employee relations.*

This factor was recognized by 50 per cent of the survivors. Most of them are enterprises manufacturing a product which requires a high degree of service or employee skill.

Before 1900 the matter of employee relations was given little notice. Labor unions were not as strong as they are now, and the strength of management discouraged much resistance. In addition, most businesses were personally supervised by proprietors or founders who took a real and friendly interest in their employees. But during the period from 1890-1905 a great many manufacturing concerns were incorporated and management became far removed from employees. It was at this time, when management changed and labor organizations grew, that difficulties in employee relationships were discovered and noted in historical data.

Having been a matter of little concern under the old business set-up, it has grown to be important and many companies have tried various means of maintaining satisfactory relations with their employees. One firm initiated a pension plan as early as 1908; another soon introduced the two week vacation with pay; and others adopted medical services, disability benefits, and group life insurance. Some increased benefits to employees with plans for profit sharing and stock purchases by employees. In two firms the employees are the majority stockholders, and one has arranged for the business eventually to be employee owned.

8. *Conservative operating policy.*

The firms recognizing this factor have operated very conservatively, their expansion being slow and financed primarily by accumulated profits. Apparent expansion opportunities have frequently been ignored until their validity has been unquestionably demonstrated. In some instances, increased volume requiring additional facilities has been rejected because of the disadvantages to old products which might result from expanded production. The absence of heavy withdrawals of capital, extravagant living, and exaggerated notions of the worth of their own services is conspicuous among the actions of the founders of the concerns recognizing this factor.

9. *Intentional training of children in the controlling families for executive positions.*

There is much importance attached to this factor. Instances were found of fathers' placing their sons, untrained and unexperienced, into executive positions and later discovering the mistake. Undoubtedly, such action was based entirely on parental pride, for the same fathers would not have placed other men with similar qualifications in the same positions. Almost without exception, the children having the most success in the operation of a business were those whose training adequately prepared them for their tasks.

10. *Flexibility permitting rapid adjustment to the production of new products.*

The benefits from this factor resulted from one of two conditions: First, the decreased demand for the old product would necessitate the adoption of an entirely new type of manufacturing activity, and second, the flexibility of the production facilities and methods would permit the addition of a new product without detrimental interruptions in the manufacture of the old products. The value of this factor was demonstrated by the large number of concerns which discontinued operations when their demand subsided. Many also were hampered by the rigidity of their manufacturing habits and failed to take advantage of the benefits obtainable through the introduction of new products possible with a slight variation in their existing facilities. In the final analysis, this factor is actually dependent upon managerial efficiency.

11. *Employment of capable administrators.*

All of the concerns which grew beyond a family controlled size recognized the benefits of this factor. In a few cases, the employment of unworthy administrators resulted in financial difficulties, one firm experiencing a nearly disastrous case of fraud. The advantages of this factor were demonstrated by a concern's rapid return to a sound operating position when inefficient executives were replaced by capable administrators. Further evidence was exhibited when capable administrators salvaged almost insolvent concerns by assuming control previously exercised by members of the controlling families.

12. *Financial policy.*

This factor primarily concerned the reinvestment of profits. A surprising number of concerns made a practice of reinvesting almost all profits during their infancy, and one partnership contract prohibited

the withdrawal of any funds from the business, either profits or capital. Some firms constantly furnished their entire working capital, and others would not resort to any outside financing. The liquidity of many during periods of extensive credit operations was a significant factor in their survival.

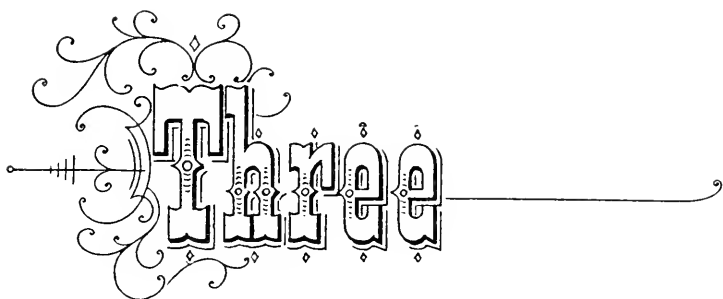
13. *Governmental action.*

This factor included mainly business activity initiated by the government. It covered expanded production because of the Civil War, World War I, W.P.A., and World War II. Its significance was probably underestimated more than any other since little recognition was given ordinary governmental aids. Among these aids, taken for granted, are protective tariffs, improvement of rivers for transportation with the building of dams and dredging. And, some companies have been especially benefited by government services in research and testing in various fields.

Only when government action had provided an outstanding contribution to longevity was it tabulated. Most of the concerns mentioning this factor were indebted to the government for one of two reasons since the government's stimulating of the demand for their products provided a particularly opportune time for the establishment of business or allowed declining companies to improve their positions. Although many were helped by the government, three believe their survival was partly dependent upon war activity, and three others admit that activity created by war enabled them to recover from very critical positions.

14. *Timely origin of the concern.*

Whenever a concern's origin coincided with the development of unusual opportunities in its field, it was considered to have experienced a timely origin. Such conditions as the development and rapid expansion of the railroad industry, the public's acceptance of canned foods, the substitution of steel for iron, the introduction of the open hearth furnace, and the Civil War provided unusual opportunities for concerns whose production catered to the newly created demand to become securely established.



CONCLUSIONS

Searching for the causes contributing to the longevity of manufacturers might be expected to reveal factors which have enabled manufacturing concerns to operate successfully. To make an intensive study of all the circumstances resulting in the success and longevity of each firm means going back 100 or 150 years to find the immediate and ultimate causes of success.

It is rarely true that a business succeeds because of only one factor, although it does seem that each success can be traced to one or two outstanding cases. A manufacturing concern may pursue an upward career for years before it is recognized as unusually successful, and a whole series of factors may have been working for its prosperity.

Success factors, like mortality factors, are difficult to isolate because they intertwine and complement each other. The existence of one is dependent upon the continuation of others. The factors contributing to success are more difficult to determine than are those contributing to mortality. Yet, a thorough study of mortality causes involved considerable effort from several individuals over a sustained period of time.

A study was made by the United States Department of Commerce, the Institute of Human Relations, and the Law School of Yale University of some six hundred failures passing under the review of one federal bankruptcy court.¹ A clinic was established by the court for a two year period. The trustees, the proprietors, the court records, and the creditors were consulted; the business practices were examined, and the opinions of various interested parties were compared. Nevertheless, the clinic had difficulty establishing the degree of importance attributable to various causes of failure in each case.

This study has analyzed the apparent factors contributing to long life operating in thirty concerns, and little attempt has been made to evaluate the data quantitatively. As many factors were listed for each firm as seemed to have been of importance for some period during the company's history, and it was apparent that different causes existed for various periods of time. A company's recognition of the operation of a factor was considered sufficient to warrant its inclusion in this study. Consequently, a relatively unimportant factor, having two years duration, was tabulated as just one covering a seventy-five year period.

In addition to the specific factors associated with each concern, it

¹ *Causes of Business Failures and Bankruptcies of Individuals in New Jersey in 1929-30*, U. S. Dept. of Commerce, Domestic Commerce Series No. 54.

appeared that several general causes contributed to their survival. Such general factors as location, power, labor, transportation, demand, and seasonal variation played significant roles in continued operation. These factors, however, are extremely difficult to measure, and have not been greatly emphasized here because all other manufacturers located in Allegheny County were subject to these similar general factors. If the proper combination of these general conditions would assure success, all manufacturers involved would still be in operation. The withdrawal of more than 98 per cent of the firms tabulated in this study indicates that causes other than these general ones were responsible for the continued operation of the survivors. Nevertheless, if the right combination of general factors had not existed, none of them would have survived until 1947.

Size is frequently advanced as a factor affecting profitability and the survival ability. Merwin stated that "...taking all manufacturing companies together, the larger firms are more profitable than the smaller when one defines profitability in terms of net income (before tax) to net worth."² Heilman found that "...investment is the decisive factor in determining the ability of a business enterprise to survive. Type of business is of little significance. The firms with substantial amounts of capital survive the longest..."³ It is true that modern practices tend to increase the life of the larger establishments, and particularly those operating under the corporate form of organization. "A corporation in financial difficulties passes into receivership which is a legal process devised to conserve the interests of owners, creditors and public.... After months or years the corporation may be dissolved.... Revision of our bankruptcy laws has placed emphasis upon rehabilitation rather than upon liquidation."⁴ But, this investigation identified survivors as solvent concerns which had not lost continuity of control through reorganization. As a result, no correlation could be established between amount of net worth and survival ability.

Almost all of the surviving manufacturers commenced operating with less than \$10,000 invested capital. By 1947 their net assets ranged from less than \$25,000 to over \$200,000,000. Sixty per cent

² Merwin, Charles L., *Financial Characteristics of American Manufacturing Corporations*, Monograph No. 15, Temporary National Economic Committee, United States Government Printing Office, Washington, p. 26 (1940).

³ Heilman, E. A., *op. cit.*, p. 11.

⁴ Cover, John H., et al, *loc. cit.*

had a net worth below \$500,000, 20 per cent below \$100,000, and 10 per cent below \$25,000. Thirteen and three-tenths per cent showed a net worth in excess of \$25,000,000, 10 per cent above \$50,000,000, and 3 per cent over \$200,000,000. As shown in Table XVI, the average net worth was between \$250,000 and \$500,000. Of course, present net worth does not represent that which existed throughout the lives of the concerns involved, but there has been little change in the relative position of the net investments during the past twenty-five years. In fact, only a few changes have occurred since 1900.

Most of the survivors have not encountered the difficulties involved in seasonal operations. Twenty-three have had comparatively steady operations throughout the year; seven firms have experienced severe seasonal variation in their operations, but two have instituted measures which have eliminated erratic seasonal production. The remaining five have attempted to level off their seasonal operations but are still plagued by the diseconomies of fluctuating production. Since 83 per cent of the surviving concerns are largely unaffected by seasonal operations, it appears that the absence of this difficulty has favorably influenced their longevity.

A favorable location has contributed almost constantly to the continued operation of most of the surviving concerns. "The major industrial advantages of the Pittsburgh district are low-cost fuel,

TABLE XVI

NUMBER OF MANUFACTURING CONCERNS OVER 75 YEARS OF AGE
IN ALLEGHENY COUNTY CLASSIFIED BY NET WORTH, 1947

<i>Net Worth</i>		<i>Number</i>	<i>Manufacturing Group*</i>
\$	10,000—\$ 25,000	3	I.M.W.
	25,000— 50,000	2	M.P.
	50,000— 100,000	1	M.
	100,000— 250,000	3	I.I.M.
	250,000— 500,000	9	I.I.W.W.P.N.N.C.C.
	500,000— 1,000,000	1	W.
	1,000,000— 5,000,000	4	I.I.M.
	5,000,000— 10,000,000	1	I.
	10,000,000— 25,000,000	2	I.I.
	25,000,000— 50,000,000	1	S.
	50,000,000— 75,000,000	1	I.
	75,000,000— 100,000,000	1	F.
	100,000,000—and over	1	I.

*The initial represents the manufacturing group in which the surviving concern was classified.

power, raw steel, and water transportation. . . ."⁵ "Furthermore, the area and adjacent districts are important sources of natural gas."⁶ "Moreover, the long-standing specialization of Pittsburgh . . . has led also to the building up of a large group of workers, skilled or semi-skilled in the operation of these industries. Knowledge of local mechanical processes has been passed down from father to son."⁷ In addition, the location has provided proximity to the sales market of the majority of the surviving manufacturers. In evaluating their location, all survivors found it favorable during the early years of their existence; twenty-four have always considered it so; one, not advantageous during the past twenty-two years; two, not during the past twenty-five years; and one not since about 1905.

Iron and steel and the nonferrous metals industries are closely allied with most of the surviving manufacturers. Twelve survivors are in the iron and steel group, five in the nonferrous metals group, two in the wood group, and two in the printing group could be classified today under iron and steel or nonferrous metals. One survivor in each of the chemical; stone, clay and glass; printing; and not elsewhere classified groups has a sales market composed principally of the iron and steel or nonferrous metals industries. Consequently, only five of the thirty survivors are not closely associated with these industries. Three of the five, however, are producers of consumers' goods. Their prosperity is greatly influenced by the purchasing power of individuals employed by metal manufacturers.

The surviving concerns have encountered various types of demand for their products. All experienced an expanding demand during their early development. Twenty-four firms believe their products have always faced a long-term expanding demand; four faced an expanding demand which leveled off and then declined, but detrimental effects were offset by substituting new products or by transferring to new manufacturing fields. Two had an expanding demand which leveled off and then gradually declined, but no material changes have been made in their products. Style changes in demand have been almost negligible for seven concerns and five believe the demand for their product was completely undeveloped when the business was founded.

The specific longevity factors which were associated with the thirty surviving concerns are summarized in Table XVII. They were tabulated

⁵ McLaughlin, Glenn E., *Growth of American Manufacturing Areas*, Bureau of Business Research, University of Pittsburgh, Pittsburgh, p. 324 (1938).

⁶ *Ibid.* ⁷ *Ibid.*, p. 331.

from the data sheets which contain information in the form in which it was originally gathered.⁸ Factors were listed according to the manner in which they were identified by each survivor. No attempt was made to group the factors into refined categories. As a result, there appears to be duplication in the fifty-five different items shown in Table XVII. Actually, each represents a distinct cause of a company's survival.

Of the fifty-five different longevity factors, "general managerial ability of specific individuals" was identified with all but one of the surviving manufacturers. Usually, the individual was connected with the firm during its early development. Most survivors, however, recognized the managerial ability of specific persons during both early and subsequent periods of operations.

The established reputation of a trade style, brand name, or trade mark was the second most frequently recognized longevity factor. Its importance has increased with the passing of time. Many instances were revealed which demonstrated the extreme importance of this factor today. Of course, its existence is dependent upon the beneficial effect of factors prevailing during the early periods of operation.

The third and fourth most frequently listed factors concerned the knowledge, action, or ability of a specific individual. Also, the ninth, eleventh, twenty-second, thirty-first, thirty-fifth, thirty-sixth, thirty-eighth, forty-second, forty-fourth and fifty-first factors involved particular individuals. Moreover, several others resulted indirectly from the action of a specific person, but they are not so classified because they were not originally identified in that manner.

"Inferiority of competitors' products" was recognized by twenty or 66.6 per cent of the concerns involved. "Product control from patents" was listed by 63.3 per cent, and "favorable employee relations" was associated with 50 per cent. All other factors were recognized by less than half of the surviving manufacturers. Many of the other factors, however, were slight deviations of another cause. If similar factors are grouped, many of the combinations reflect more than 50 per cent recognition.

When each item is multiplied by the number of times it was mentioned, the various factors were listed 439 times. By grouping the number of times similar factors were listed into homogeneous categories, the relative value of similar factors is more readily demonstrated. Table XVIII shows that 135 of the 439 times the factors were listed they

⁸ See Appendix U 1-30, inclusive.

TABLE XVII
FACTORS CONTRIBUTING TO THE LONGEVITY OF THIRTY
MANUFACTURING CONCERNS, IN ALLEGHENY COUNTY,
WHICH SURVIVED THE 1873-1947 PERIOD

<i>Factor</i>	<i>Number of Firms Recognizing Factor</i>	<i>Per cent of Total Firms</i>
General managerial ability of specific individuals.....	29	96.6
Established reputation of trade styles, brand names, etc.....	28	93.3
Birth of children within the controlling families willing and capable of successfully continuing the firm.....	26	86.6
Experience of the founders prior to origin of the firm.....	25	83.3
Inferiority of competitors' products.....	20	66.6
Product control from patents.....	19	63.3
Favorable employee relations.....	15	50.0
Conservative operating policy.....	14	46.6
Intentional training of children in the controlling families for executive positions	14	46.6
Flexibility permitting rapid adjustment to the production of new products	14	46.6
Employment of capable administrators.....	13	43.3
Financial policy—heavy reinvestment of profits.....	13	43.3
Governmental action	13	43.3
Timely origin of the concern.....	11	36.6
Availability of financing during critical periods.....	10	33.3
Adequate financing during early years of operation.....	10	33.3
Limiting expansion to a size readily controlled by the personal supervision of members of the controlling family.....	10	33.3
Control over raw materials.....	10	33.3
Early entrance into a particular manufacturing field.....	9	30.0
Intensive product research and development.....	9	30.0
Pioneering of new products.....	9	30.0
Inventive ability of specific individuals.....	8	26.6
Inferiority of competitors' services.....	7	23.3
Favorable financing connections	7	23.3
Catering to a particular segment of the sales market.....	7	23.3
Pioneered manufacturing in a specific field.....	6	20.0
Rapid adoption of new machinery and new methods of production	6	20.0

TABLE XVII (CONTINUED)

FACTORS CONTRIBUTING TO THE LONGEVITY OF THIRTY
MANUFACTURING CONCERNS, IN ALLEGHENY COUNTY,
WHICH SURVIVED THE 1873-1947 PERIOD

<i>Factor</i>	<i>Number of Firms Recognizing Factor</i>	<i>Per cent of Total Firms</i>
Originating and instituting of new methods of production . . .	6	20.0
Periods of ineffective competition or complete absence of competition	5	16.6
Protection against fire risks	5	16.6
Association of owners with customers	4	13.3
Control over fuel supply	4	13.3
Flexibility permitting rapid adjustment to new methods of distribution	4	13.3
Superiority of production methods over competitors' tech- niques	4	13.3
Intention to perpetuate firm because of pride rather than profit	4	13.3
Conservative Scotch-Presbyterian influence	4	13.3
Manufacture of a diversified line of products	4	13.3
Production supervision by specific individuals	3	10.0
Marketing methods	3	10.0
Timeliness of expansion program	3	10.0
Price, territory or product agreements	2	6.6
Knowledge of sales market—specific individuals	2	6.6
Standardization of production methods	2	6.6
Previous experience of individuals entering firm subsequent to the early period of operations	2	6.6
Succeeding original producer in a particular field	2	6.6
Acquisition of competitive concerns	2	6.6
Extension of debt maturity by creditors	2	6.6
Instituting measures to counteract seasonal operations	2	6.6
Control over transportation	2	6.6
Concentrated sales territory	1	3.3
Favorable political connections	1	3.3
Discovery of deposits of superior raw materials	1	3.3
Extensive advertising	1	3.3
Liberal profit-sharing plan for top management	1	3.3
Developed new method of distribution	1	3.3

directly involved the ability, knowledge, or action of a specific individual. Sixty-five listings concerned some phase of control of a monopolistic nature, such as, dominance over raw material source, fuel supply or transportation. The product and its production were mentioned sixty-four times, but these listings were divided into thirty for the product and thirty-four for production methods. The three groupings of specific individuals, control, and the product and its production include 60 per cent of the times longevity factors were acknowledged.

TABLE XVIII

THE DISTRIBUTION BY MAJOR CATEGORIES OF THE NUMBER OF TIMES LONGEVITY FACTORS WERE ASSOCIATED WITH MANUFACTURING CONCERNS WHICH SURVIVED THE 1873-1947 PERIOD

<i>Major Category</i>	<i>Number of Listings</i>	<i>Per Cent of Total Listings</i>
Specific individuals	135	30.7
Control (monopolistic elements)	65	14.8
Financing	42	9.6
Production methods	34	7.7
Competition	34	7.7
Time element (origin or expansion)	31	7.1
The product	30	6.8
Operating policy	24	5.5
Employee relations	16	3.6
Governmental action	13	3.0
Marketing methods	10	2.3
Protection against risks.....	5	1.1
Total	439	99.9

Nine and six-tenths per cent of the listing concerned some phase of financing, 7.7 per cent involved competition, and 7.1 per cent the time element of origin or expansion. In several instances the same factor was related to more than one category, but it was classified according to its predominate nature. Even if the factors comprising the first seven categories were rearranged, they would be classified under other headings included in the same seven categories. Consequently, 84.5 per cent of the times factors were listed they concerned "specific individuals," "product and methods of production," "financing," "competition," "control," and "time element." It follows that these items represent the leading apparent reasons for the longevity of the concerns involved. Moreover, since more of these factors concern either a specific individual or

his indirect influence upon some phase of management, specific individuals dominate as contributors to the longevity of the surviving concerns.

MEASUREMENT AND STATISTICAL ANALYSIS OF LONGEVITY OF MANUFACTURERS LOCATED IN ALLEGHENY COUNTY BETWEEN 1856-1873

A large portion of the body of this study together with appendices A to T, inclusive, is devoted to the statistical analysis and measurement of the longevity of all manufacturing concerns included in the investigation. Information is tabulated and analyzed regarding average age in given years, average life for shifting periods of time, birth rates, mortality rates, survival ratios, periods of high or low mortality, rates of growth, and life expectancy. In addition, similar information is provided for each manufacturing division in the sections dealing with specific manufacturing groups. The nature and extent of this information prevents valid interpretation without extensive duplication of previously summarized data. Consequently, it is omitted from this section of the presentation of the study.

COMPARISON OF LONGEVITY FACTORS WITH MORTALITY FACTORS

If the various mortality studies have correctly determined the leading causes of failure of manufacturers, it would seem logical that longevity factors should represent opposite conditions. Proof of this assumption, however, could only be obtained by comparing mortality and longevity factors uncovered by comprehensive studies which have unquestionably determined the true causes. Unfortunately, such desirable results are unobtainable. A few mortality studies have established the apparent causes of failure. This investigation has attempted to determine the apparent causes of longevity. But, a comparison of these apparent longevity and mortality factors might ignore more valid reasons which were not revealed. Moreover, the absence of factors which appear to contribute to longevity may never be considered as such in the determination of mortality factors. For instance, the longevity factor of the "production of a superior product" would be unlikely to appear in a failure study as the "production of an inferior product."

Instead, the failure study would probably reveal "lack of capital," "poor distribution methods," or "inefficient management." Any, or all of these reasons could possess validity, but the "production of a superior product" might counterbalance the existence of all three apparent causes, save the business from failure, and prevent the causes from being disclosed. Nevertheless, the comparison of the apparent longevity factors disclosed by this investigation with the apparent mortality factors revealed by other studies may serve to emphasize the importance of the existence or nonexistence of certain factors in determining business success or failure.

Such a comparison is complicated by the conclusion reached in the studies being contrasted. This investigation disclosed fifty-five different factors, comprising twelve general categories, which apparently contributed to survival.

Most mortality studies have causes of failures grouped under management difficulties, lack of capital, and specific conditions. Management difficulties include incompetence, inexperience, extravagance, neglect, speculation, dissension, unwise granting of credits, and over-expansion — and they usually account for 30 to 50 per cent of the total failures studied. Lack of capital in some years has been the more important cause in a few studies, but it is likely to be a superficial symptom rather than a basic cause. It is a great temptation to consider lack of capital as the primary cause in all cases of failure, since inability to meet obligations is proof of inadequate capital. Specific conditions usually include competition, change in demand, operation of the business cycle, casualties, and other so-called outside causes.

Most mortality studies have named management difficulties as the leading causes of failure, with incompetence the dominating factor and inexperience the second most frequent contributor. This investigation found management by specific individuals to be the leading cause for success with general managerial ability making the most frequent contribution, and experience was the fourth factor most frequently mentioned. Both types of studies, therefore, agree that management presents the predominate determinate in business success or failure.

The second most frequently listed group of factors in this longevity study is "control" (monopolistic elements). This group includes such factors as control over source of fuel, raw materials, markets, transportation, and product control from patents. Also, established reputation of trade styles, brand names, and trade marks. No mortality study could

be located which listed the absence of any of these factors as a cause of failure.

In mortality studies lack of capital is the second most frequently listed general cause of business failures. Favorable financing in the form of availability, adequacy and financial connections was the third most frequently mentioned group of factors in this longevity study.

Specific conditions listed in mortality studies are comprised of those outside factors which are largely uncontrollable by a particular business. The general factors in this longevity study of demand, location, and seasonal variation represent a similar grouping. The unfavorableness of these factors apparently account for the third largest group of business failures, and from 75 per cent upward of the surviving concerns investigated in this study have experienced favorable general factors.

From the preceding comparisons, it appears that with the understandable exception of the control category, the opposite of the three leading apparent general causes of failure represent the three leading general categories of factors which contribute to the longevity of manufacturing concerns: management, financing, general factors of demand, location, and seasonal variation.

Appendices

APPENDIX A

THE DISTRIBUTION OF MANUFACTURING CONCERNS, ACCORDING TO THEIR AGE, MANUFACTURING GROUP
AND ACCUMULATED NUMBER BY YEARS OF AGE, IN BUSINESS IN 1856

Years of Age	CHEMICALS		FOOD		LEATHER		METALS IRON & STEEL		METALS NONFERROUS		NOT ELSEWHERE CLASSIFIED		PETROLEUM		PRINTING		STONE, CLAY AND GLASS		WOOD		TOTAL
	No. of Firms	Accum. No.	No. of Firms	Accum. No.	No. of Firms	Accum. No.	No. of Firms	Accum. No.	No. of Firms	Accum. No.	No. of Firms	Accum. No.	No. of Firms	Accum. No.	No. of Firms	Accum. No.	No. of Firms	Accum. No.	No. of Firms	Accum. No.	
1	3	15	19	49	4	26	26	124	10	34	7	35	1	13	35	8	46	28	69	117	434
2	1	12	2	30	3	22	3	98	1	24	1	28	1	2	22	3	38	3	41	19	316
3	11	1	1	28	1	19	11	95	1	23	2	27	1	1	20	3	35	4	38	21	297
4	11	1	1	27	1	18	1	84	1	23	2	27	1	1	19	2	32	4	34	12	276
5	1	11	5	26	1	17	10	83	4	22	2	25	1	1	19	3	30	3	30	29	264
6	10	2	21	16	1	16	73	73	1	18	1	23	1	1	19	1	27	1	27	6	235
7	1	10	2	19	1	16	7	73	1	18	7	22	1	1	18	5	26	4	26	28	229
8	9	9	17	17	1	15	1	66	2	17	1	15	1	1	18	2	21	1	22	7	201
9	9	9	2	17	1	14	5	65	1	15	2	15	1	3	18	1	19	1	21	15	194
10	9	9	5	15	13	8	60	1	15	1	13	1	1	1	15	1	18	5	20	21	179
11	9	9	10	10	13	5	52	1	14	1	13	1	1	1	14	2	17	2	15	11	158
12	1	9	4	10	13	2	47	1	14	1	12	1	1	1	13	1	15	1	13	10	147
13	1	8	6	6	1	13	6	45	1	13	1	12	1	1	13	2	14	1	13	12	137
14	7	7	6	6	1	12	4	39	1	13	1	11	1	1	13	2	12	2	12	11	125
15	7	7	1	6	3	11	2	35	1	13	1	10	1	1	12	1	10	1	10	9	114
16	2	7	1	5	8	3	33	1	12	1	9	9	1	4	12	1	10	2	9	14	105
17	2	5	4	4	8	3	30	1	12	1	8	8	1	1	8	1	9	1	7	9	91
18	1	3	4	4	8	3	27	4	11	4	7	7	1	2	7	9	9	2	6	12	82
19	2	2	4	4	1	8	1	24	1	7	1	7	1	1	5	1	9	1	4	5	70
20	2	2	4	4	1	7	2	23	1	6	1	6	1	1	5	1	8	1	4	3	65
21	1	2	4	4	1	7	4	21	1	6	1	6	1	1	5	1	8	3	9	62	53
22	1	1	4	4	6	6	2	17	5	5	5	5	5	1	5	5	7	3	3	2	51
23	1	1	4	4	6	6	15	15	5	5	5	5	5	1	5	5	7	3	3	2	49
24			1	4	6	6	2	15	5	5	5	5	5	1	4	4	7	3	3	4	49

25	1	3	1	6	1	13	2	5	2	5	3	3	1	7	2	1	8	45
26		3	1	5		13		3	1	3	3	3		6		1	8	37
27		2	1	5		12		3		2	3	3	4	6			4	93
28		2	1	4		10		3		2	3	3		2			5	28
29		2		3		9		3		2	3	3		2			4	24
30		2		3		8		3		2	3	3		2			1	23
31	1	2		3		7		3	1	2		1		2			3	22
32		1		3		7	1	3		1		2		2			3	19
33		1		3		5		2		1		2		2			1	16
34		1	2	3		4		2		1		2		2			2	15
35		1		1		4		2		1		2		2			13	15
36		1		1		4	1	2		1		2		2			1	13
37		1		1		4		1		1		2		2				12
38		1		1		4		1		1		2		2				12
39	1	1		1		4		1		1		2		2		3		12
40		1		1		3		1		1		1		2			1	9
41		2		1		3		1		1		1		2				9
42				1		2		1		1		1		2				8
43				1		2		1		1		1		2			1	8
44				1		2		1	1			1		2			1	7
45				1		2	1	1				1	1	2			2	6
46				1		2							1	1				4
47			1	1		2								1			1	4
48			1	1		1							1	1			1	3
49				1		1								1				
55				1		1											1	2
64			1	1		1											1	1

APPENDIX B

THE PERCENTAGE DISTRIBUTION OF MANUFACTURING CONCERNS, ACCORDING TO THEIR AGE,
MANUFACTURING GROUP AND ACCUMULATED PERCENTAGES BY YEARS OF AGE, IN BUSINESS IN 1856

Years of Age	CHEMICALS		FOOD		LEATHER		METALS IRON & STEEL		METALS NONFERROUS		NOT ELSEWHERE CLASSIFIED		PETROLEUM		PRINTING		STONE, CLAY AND GLASS		WOOD		TOTAL		
	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	
1	20.0	100.0	38.8	100.0	15.4	100.0	21.0	100.0	29.4	100.0	20.0	100.0	100.0	100.0	37.1	100.0	17.4	100.0	40.6	100.0	27.0	100.0	
2	6.7	80.0	4.1	61.2	11.3	84.6	2.4	79.0	2.9	70.1	2.9	80.1	100.0	100.0	5.7	62.9	6.5	82.6	4.3	59.4	4.4	72.8	
3		79.3	2.0	57.1	3.8	73.1	8.9	76.6		67.6		77.1	100.0	100.0	2.9	57.1	6.5	76.1	5.8	55.1	4.8	68.4	
4		73.3	2.0	55.1	3.8	69.2	.8	67.7	2.9	67.7	5.7	77.1	100.0	100.0		54.3	4.3	69.6	5.8	49.3	2.8	63.6	
5	6.7	73.3	10.2	53.1	3.8	65.4	8.1	66.9	11.8	64.7	5.7	71.4	100.0	100.0		54.3	6.5	65.2	4.3	43.5	6.7	60.9	
6		66.7	4.1	42.9		61.5		58.9		52.9	2.9	65.7	100.0	100.0	2.9	54.3	2.2	58.7	1.4	39.1	1.4	54.1	
7	6.7	66.7	4.1	38.8	3.8	61.5	5.6	58.9	2.9	52.9	20.0	62.9	100.0	100.0		51.4	10.9	56.5	5.8	37.7	6.5	52.8	
8		60.0		34.7	3.8	57.7	.8	53.2	5.9	50.0		42.9	100.0	100.0		51.4	4.3	45.7	1.4	31.9	1.6	46.3	
9		60.0	4.1	34.7	3.8	53.8	4.0	52.4		44.1	5.7	42.9	100.0	100.0		51.4	2.2	41.3	1.4	30.4	3.5	44.7	
10		60.0	10.2	30.6		50.0	6.5	48.4	2.9	44.1		37.1	100.0	100.0	2.9	42.9	2.2	39.1	7.2	29.0	4.8	41.2	
11		60.0		20.4		50.0	4.0	41.9		41.2	2.9	37.1	100.0	100.0	2.9	40.0	4.3	36.9	2.9	21.7	2.5	36.4	
12	6.7	60.0	8.2	20.4		50.0	1.6	37.9	2.9	41.2		34.3	100.0	100.0		37.1	2.2	32.6	18.8	2.3	33.9		
13	6.7	53.3		12.2	3.8	50.0	4.8	36.3		38.2	2.9	34.3				37.1	4.3	30.4	1.4	18.8	2.8	31.6	
14		46.7		12.2	3.8	46.2	3.2	31.5		38.2	2.9	21.4			2.9	37.1	4.3	26.1	2.9	17.4	2.5	28.8	
15		46.7	2.0	10.2	11.5	42.3	1.6	28.2	2.9	38.2	2.9	28.5				34.3		21.7	1.4	14.5	2.1	26.3	
16	13.3	46.7	2.0	10.2		30.8	2.4	26.6		35.3	2.9	25.7			11.4	34.3	2.2	21.7	2.9	13.0	3.2	24.2	
17	13.3	33.3		8.2		30.8	2.4	24.2	2.9	35.3	2.9	22.9			2.9	22.9		19.6	1.4	10.1	2.1	21.0	
18	6.7	20.0		8.2		30.8	2.4	21.8	11.8	32.3		20.0			5.7	20.0		19.6	2.9	8.7	2.8	18.9	
19		13.3		8.2	3.8	30.8	.8	19.4	2.9	20.6	2.9	20.0				14.3	2.2	19.6		5.8	1.1	16.1	
20		13.3		8.2		26.9	1.6	18.5		16.7		17.1				14.3		17.4	1.4	5.8	.7	15.0	
21	6.7	13.3		8.2	3.8		26.9	3.2	16.9	2.9	16.7	17.1				14.3	2.2	17.4		4.3	2.1	14.3	
22		6.7		8.2		23.1	1.6	13.7		14.7		14.3				14.3		15.2		4.3	.5	12.2	
23	6.7	6.7		8.2		23.1		12.1		14.7		14.3			2.9	14.3		15.2		4.3	.5	11.8	
24			2.0	8.2		23.1	1.6	12.1		14.7		14.3			2.9	11.4		15.2		4.3	.9	11.3	

APPENDIX C

THE DISTRIBUTION OF MANUFACTURING CONCERNS, ACCORDING TO THEIR AGE, MANUFACTURING GROUP
AND ACCUMULATED NUMBER BY YEARS OF AGE, IN BUSINESS IN 1873

Years of Age	CHEMICALS		FOOD		LEATHER		METALS IRON & STEEL		METALS NONFERROUS		NOT ELSEWHERE CLASSIFIED		PETROLEUM		PRINTING		STONE, CLAY AND GLASS		WOOD		TOTAL		
	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	No. of Firms	No. of Accum.	
1	3	35	1	63	7	63	20	206	10	95	3	61	7	37	4	53	13	94	11	118	79	825	
2	2	32	7	62	4	56	11	186	10	85	6	58	4	30	6	49	11	81	10	107	71	746	
3	4	30	6	55	10	52	13	175	7	75	2	52	2	26	8	43	3	70	13	97	68	675	
4	5	26	6	49	11	42	15	162	1	68	6	50	2	24	7	35	9	67	10	84	72	607	
5		21	11	43	4	31	10	147	9	67	7	44	4	22	4	28	9	58	7	74	65	535	
6	1	21	2	32	8	27	12	137	11	53	7	37	3	18	4	24	5	49	6	67	59	470	
7	2	20	3	30	3	19	7	125	7	47	2	30	1	15	3	20	5	44	8	61	41	411	
8	2	18	1	27	1	16	6	118	3	40	2	28		14	2	17	1	39	5	53	23	370	
9	1	16	1	26	1	15	7	112	3	37	2	26	4	14		15	4	38	3	48	26	347	
10		15	3	25	3	14	13	105		34	4	24	4	10	1	15	2	34	5	45	35	321	
11	1	15		22		11	9	92	2	34		20	1	6		14	3	32	2	40	18	286	
12	1	14	2	22		11	6	83	2	32	1	20	1	5		14		29	3	38	16	268	
13		13	3	20	1	11	4	77	3	30		19	2	4	1	14	2	29	2	35	18	252	
14	2	13	1	17		10	3	73	1	27	1	19	1	2		13	3	27	4	33	16	234	
15		11	1	16	2	10	3	70	2	26	1	18		1		13	3	24	5	29	17	218	
16	1	11	2	15		8	3	67	5	24		17	1	1	2	13		21	2	24	16	201	
17	1	10	2	13		8	2	64	2	19	3	17				11	1	21	2	22	13	185	
18	1	9		11	1	8	8	62	5	17		14			5	11		20	6	20	26	172	
19		8		11		7	1	54		12		14				6	1	20	1	14	3	146	
20		8	1	11		7	5	53		12		14				6		19	1	13	7	143	
21		8	1	10		7		48	1	12	2	14				6		19	2	12	7	136	
22	1	8	2	9	1	6	5	48		11		12				6	1	19	1	10	11	129	
23		7	1	7		5		43		11	1	12			1		6	1	18	9	4	118	
24	1	7		6		5	2	43	1	11	1	11			1		5	3	17	1	9	10	114
25		6		6	1			41	1	10		10				4	2	14	1	8	5	104	
26		6	1	6		4	3	41		9	1	10				4	1	12	1	7	7	99	
27		6		5		4	6	38		9		9				4		11	1	6	7	92	
28		6		5		4	4	32		9	1	9				4	1	11	1	5	7	85	
29	1	6	3	5		4	2	28		9		8					1	10		4	7	78	
30	1	5		2		4	3	26		9	1	8			4			9		4	5	71	

APPENDIX D

THE PERCENTAGE DISTRIBUTION OF MANUFACTURING CONCERNS, ACCORDING TO THEIR AGE, MANUFACTURING GROUP AND ACCUMULATED PERCENTAGES BY YEARS OF AGE, IN BUSINESS IN 1873

Years of Age	CHEMICALS		FOOD		LEATHER	IRON & STEEL	METALS NONFERROUS	NOT ELSEWHERE CLASSIFIED	PETROLEUM	PRINTING	STONE, CLAY AND GLASS	WOOD	TOTAL
	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms	% of Accum.	% of Firms
1	8.6	100.0	1.6	100.0	11.1	100.0	9.7	100.0	4.9	100.0	18.9	100.0	9.3
2	5.7	91.4	11.1	98.4	6.3	89.0	5.3	90.3	9.8	95.1	11.7	86.2	8.5
3	11.4	85.7	9.5	87.3	15.9	82.6	7.4	85.0	10.8	81.1	10.8	81.1	8.5
4	14.3	74.3	9.5	77.8	17.5	66.7	7.3	78.0	5.4	70.3	3.2	74.5	11.0
5	60.0	17.5	68.2	6.3	49.2	4.9	71.4	9.5	72.1	66.0	9.6	71.3	8.5
6	2.9	60.0	3.2	50.8	12.7	42.9	5.8	66.5	11.5	52.9	9.6	61.7	5.9
7	5.7	57.1	4.8	47.6	4.8	30.2	3.4	60.7	2.7	45.3	5.3	52.1	5.1
8	5.7	51.4	1.6	42.9	1.6	25.4	2.9	57.3	2.7	37.7	5.3	46.8	6.8
9	2.9	45.7	1.6	41.3	1.6	23.8	3.4	54.4	3.3	32.1	1.1	41.4	4.3
10	42.9	4.8	39.7	4.8	22.2	6.3	51.0	3.3	10.8	28.3	4.2	40.4	2.5
11	2.9	42.9	34.9	3.9	17.5	4.4	44.7	6.5	10.8	1.9	2.1	36.2	4.3
12	2.9	40.0	3.2	34.9	17.5	2.9	40.3	1.6	2.7	26.4	3.2	34.0	1.7
13	37.1	4.8	31.7	1.6	17.5	1.9	37.4	3.1	13.5	26.4	3.2	30.9	2.5
14	5.7	37.1	1.6	27.0	15.9	1.5	35.4	1.6	10.8	1.9	2.1	30.9	1.7
15	31.4	1.6	25.4	3.2	15.9	1.5	34.0	1.6	5.4	24.6	3.2	28.7	3.4
16	2.9	31.4	3.2	23.8	12.7	1.5	32.5	2.7	2.7	24.6	3.2	25.5	4.3
17	2.9	28.6	3.2	20.6	12.7	1.0	31.1	4.9	2.7	3.8	24.6	22.3	1.7
18	2.9	25.7	17.5	1.6	12.7	3.9	30.1	2.7	2.7	20.7	1.1	22.3	1.7
19	22.9	17.5	11.1	1.5	11.1	2.4	25.7	2.7	13.5	9.4	20.7	21.3	5.1
20	22.9	1.6	17.5	11.1	11.1	2.4	25.7	2.7	10.8	11.3	1.1	21.3	8
21	22.9	1.6	15.9	1.6	11.1	2.4	23.3	3.3	5.4	11.3	11.3	20.2	8
22	2.9	22.9	3.2	14.3	1.6	9.5	2.4	19.7	2.7	11.3	1.1	20.2	1.7
23	20.0	1.6	11.1	9.5	7.9	1.0	20.9	1.6	2.7	1.9	11.3	15.6	8.5
24	2.9	20.0	9.5	1.6	7.9	1.0	20.9	1.6	18.0	1.9	3.2	19.1	7.6
25	17.1	9.5	9.5	1.6	7.9	1.0	19.9	1.6	16.4	7.6	2.1	14.9	8
26	17.1	1.6	9.5	7.9	6.3	1.5	19.9	1.6	16.4	7.6	1.1	12.8	8
27	17.1	7.9	7.9	7.9	6.3	2.9	18.5	1.6	14.7	7.6	1.1	11.7	8
28	17.1	7.9	7.9	7.9	6.3	1.9	15.5	1.6	14.7	7.6	1.1	11.7	8
29	17.1	7.9	7.9	7.9	6.3	1.0	13.6	1.6	13.1	7.6	1.1	10.6	8
30	2.9	14.3	3.2	3.2	6.3	1.5	12.6	1.6	13.1	7.6	1.1	9.6	8

APPENDIX E
NUMBER AND PERCENTAGE OF MANUFACTURING FIRMS EXISTING IN 1873 AND SURVIVING
EACH YEAR OF THE PERIOD 1873-1947 (BY MANUFACTURING GROUP)

Year	CHEMICALS		FOOD		LEATHER		METALS IRON & STEEL		METALS NONFERROUS		NOT ELSEWHERE CLASSIFIED		PETROLEUM		PRINTING		STONE, CLAY AND GLASS		WOOD		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1873	35	100.0	63	100.0	63	100.0	206	100.0	95	100.0	61	100.0	37	100.0	53	100.0	94	100.0	118	100.0	825	100.0
1874	31	88.6	55	87.3	54	85.7	193	93.7	91	95.8	55	90.2	33	89.2	48	90.6	85	90.4	107	91.8	752	91.2
1875	29	82.9	52	82.5	49	77.8	178	86.4	87	91.6	49	80.3	32	86.5	43	81.1	79	84.0	98	83.1	696	84.4
1876	28	80.0	48	76.2	48	76.2	171	83.0	86	90.5	45	73.8	29	78.4	41	77.4	79	84.0	94	79.7	669	81.1
1877	26	74.3	45	71.4	41	65.1	160	77.7	82	86.3	43	70.5	25	67.6	35	66.0	70	74.5	84	71.2	611	74.1
1878	24	68.6	43	68.3	40	63.5	153	74.3	78	82.1	42	68.9	21	56.8	31	58.5	65	69.2	80	67.8	577	69.9
1879	23	65.7	41	65.1	38	60.3	146	70.9	74	77.9	40	65.6	19	51.4	29	54.7	64	68.1	73	61.9	547	66.3
1880	22	62.9	40	63.5	36	57.1	139	67.5	71	74.7	38	62.3	14	37.8	28	52.8	61	64.9	70	59.3	519	62.9
1881	22	62.9	37	58.7	33	52.4	134	65.1	68	71.6	36	59.0	14	37.8	28	52.8	58	61.7	67	56.8	497	60.2
1882	22	62.9	37	58.7	33	52.4	127	61.7	63	66.3	35	59.0	13	35.1	25	47.2	54	57.5	62	52.5	472	57.2
1883	21	60.0	37	58.7	33	52.4	125	60.7	63	66.3	32	52.5	11	29.7	24	45.3	53	56.4	60	50.9	459	55.6
1884	20	57.1	36	57.1	32	50.8	123	59.7	62	65.3	29	47.5	10	27.0	24	45.3	52	55.3	57	48.3	455	55.2
1885	20	57.1	36	57.1	28	44.4	121	58.7	61	64.2	26	42.6	10	27.0	23	43.4	51	54.3	55	46.6	431	52.2
1886	20	57.1	34	54.0	26	41.3	120	58.3	56	59.0	23	37.7	9	24.3	22	41.5	49	52.1	51	43.2	410	49.7
1887	19	54.3	32	50.8	26	41.3	113	54.9	52	54.7	21	34.4	9	24.3	22	41.5	47	50.0	47	39.8	388	47.0
1888	19	54.3	32	50.8	25	39.7	111	53.9	48	50.5	20	32.8	8	21.6	19	35.9	44	46.8	44	37.3	370	44.9
1889	18	51.4	32	50.8	22	34.9	108	52.4	45	47.4	20	32.8	6	16.3	18	34.0	43	45.8	42	35.6	354	42.9
1890	18	51.4	31	49.2	21	33.3	103	50.0	42	44.2	19	31.2	4	10.8	18	34.0	40	42.5	40	33.9	336	40.7
1891	17	48.6	30	47.6	20	31.8	100	48.5	38	40.0	17	27.9	3	8.1	18	34.0	40	42.6	37	31.4	320	38.8
1892	13	37.1	27	42.9	19	30.2	99	48.1	35	36.8	15	24.6	3	8.1	17	32.1	34	36.2	36	30.1	298	36.1
1893	12	34.3	27	42.9	19	30.2	96	46.6	32	33.7	15	24.6	3	8.1	16	30.2	33	35.1	35	29.7	288	34.9
1894	11	31.4	26	41.3	17	27.0	93	45.1	31	32.6	14	23.0	3	8.1	16	30.2	32	34.0	33	28.0	276	33.5
1895	11	31.4	25	39.7	17	27.0	89	43.2	27	28.4	13	21.3	3	8.1	15	28.3	31	33.0	31	26.3	262	31.8
1896	11	31.4	24	38.1	16	25.4	87	42.2	26	27.4	12	19.7	2	5.4	14	26.4	31	33.0	31	26.3	254	30.8

1897	11	31.4	24	38.1	16	25.4	86	41.8	26	27.4	12	19.7	2	5.4	14	26.4	27	28.7	28	23.7	246	29.8
1898	11	31.4	24	38.1	16	25.4	82	39.8	26	27.4	12	19.7	2	5.4	13	24.5	26	27.7	26	22.0	238	28.9
1899	11	31.4	23	36.5	16	25.4	79	38.4	24	25.3	12	19.7	2	5.4	13	24.5	24	25.5	25	21.2	229	27.8
1900	11	31.4	14	22.2	12	19.0	69	38.5	24	25.3	11	18.0	2	5.4	13	24.5	21	22.3	24	20.3	201	24.4
1901	11	31.4	14	22.2	12	19.0	60	29.1	23	24.2	11	18.0	2	5.4	12	22.6	19	22.2	22	18.6	186	22.6
1902	11	31.4	14	22.2	12	19.0	55	26.7	22	23.2	10	16.4	1	2.7	11	20.7	17	18.1	22	18.6	175	21.2
1903	9	25.7	12	19.0	12	19.0	54	26.2	20	21.1	10	16.4	1	2.7	11	20.7	13	13.8	20	17.0	162	19.6
1904	9	25.7	12	19.0	12	19.0	52	25.2	17	17.9	10	16.4	1	2.7	11	20.7	13	13.8	18	15.3	155	18.8
1905	9	25.7	12	19.0	12	19.0	50	24.3	17	17.9	10	16.4	1	2.7	11	20.7	13	13.8	18	15.2	153	18.6
1906	9	25.7	12	19.0	12	19.0	50	24.3	17	17.9	9	14.7	0	0.0	11	20.7	12	12.8	16	13.6	148	17.9
1907	9	25.7	12	19.0	11	17.5	49	23.8	16	16.8	9	14.7	0	0.0	11	20.7	12	12.8	14	11.9	143	17.3
1908	9	25.7	9	14.3	11	17.5	48	23.3	15	15.8	9	14.7	0	0.0	11	20.7	11	11.7	14	11.9	137	16.6
1909	9	25.7	7	11.1	11	17.5	46	22.3	14	14.7	8	13.1	0	0.0	10	18.9	10	10.6	13	11.0	129	15.6
1910	8	22.9	7	11.1	10	15.9	44	21.4	13	13.7	7	11.5	0	0.0	10	18.9	8	8.5	13	11.0	120	14.6
1911	8	22.9	6	9.5	10	15.9	43	20.9	11	15.8	7	11.5	0	0.0	9	17.0	8	8.5	13	11.0	115	13.9
1912	8	22.9	5	7.9	9	14.3	42	20.4	11	15.8	7	11.5	0	0.0	8	15.1	8	8.5	13	11.0	111	13.5
1913	8	22.9	5	7.9	8	12.7	40	19.4	11	15.8	7	11.5	0	0.0	8	15.1	8	8.5	12	10.2	107	13.0
1914	7	20.0	5	7.9	7	11.1	39	18.9	10	10.5	7	11.5	0	0.0	8	15.1	8	8.5	11	9.3	102	12.4
1915	6	17.1	5	7.9	7	11.1	39	18.9	10	10.5	5	8.2	0	0.0	8	15.1	8	8.5	11	9.3	99	12.0
1916	6	17.1	5	7.9	6	9.5	38	18.5	10	10.5	5	8.2	0	0.0	8	15.1	7	7.5	11	9.3	96	11.6
1917	6	17.1	4	6.3	5	7.9	35	17.0	10	10.5	4	6.6	0	0.0	8	15.1	5	5.3	11	9.3	88	10.7
1918	6	17.1	4	6.3	5	7.9	34	16.5	10	10.5	4	6.6	0	0.0	8	15.1	5	5.3	11	9.3	87	10.5
1919	6	17.1	4	6.3	4	6.3	32	15.5	10	10.5	3	4.9	0	0.0	8	15.1	5	5.3	11	9.3	83	10.1
1920	5	14.3	4	6.3	4	6.3	28	13.6	10	10.5	3	4.9	0	0.0	8	15.1	4	4.3	9	7.6	75	9.1
1921	5	14.3	4	6.3	3	4.8	28	13.6	10	10.5	3	4.9	0	0.0	8	15.1	4	4.3	8	6.8	73	8.9
1922	5	14.3	4	6.3	3	4.8	28	13.6	10	10.5	3	4.9	0	0.0	8	15.1	4	4.3	8	6.8	73	8.9
1923	4	11.4	3	4.8	3	4.8	26	12.6	10	10.5	3	4.9	0	0.0	7	13.2	4	4.3	8	6.8	68	8.2
1924	4	11.4	2	3.2	3	4.8	26	12.6	10	10.5	3	4.9	0	0.0	7	13.2	4	4.3	8	6.8	67	8.1
1925	4	11.4	1	1.6	3	4.8	26	12.6	10	10.5	3	4.9	0	0.0	7	13.2	4	4.3	8	6.8	66	8.0
1926	4	11.4	1	1.6	2	3.2	25	12.1	10	10.5	3	4.9	0	0.0	6	11.3	4	4.3	8	6.8	63	7.6
1927	4	11.4	1	1.6	2	3.2	25	12.1	10	10.5	3	4.9	0	0.0	6	11.3	3	3.2	8	6.8	62	7.5
1928	4	11.4	1	1.6	2	3.2	25	12.1	10	10.5	3	4.9	0	0.0	6	11.3	3	3.2	8	6.8	62	7.5
1929	4	11.4	1	1.6	2	3.2	25	12.1	10	10.5	3	4.9	0	0.0	6	11.3	3	3.2	8	6.8	62	7.5
1930	4	11.4	1	1.6	2	3.2	22	10.7	10	10.5	3	4.9	0	0.0	6	11.3	3	3.2	7	5.9	58	7.0
1931	4	11.4	1	1.6	2	3.2	20	9.7	10	10.5	3	4.9	0	0.0	6	11.3	3	3.2	7	5.9	56	6.8
1932	4	11.4	1	1.6	1	1.6	20	9.7	8	8.4	3	4.9	0	0.0	6	11.3	2	2.1	7	5.9	52	6.3

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APPENDIX E (CONTINUED)
 NUMBER AND PERCENTAGE OF MANUFACTURING FIRMS EXISTING IN 1873 AND SURVIVING
 EACH YEAR OF THE PERIOD 1873-1947 (BY MANUFACTURING GROUP)

Year	CHEMICALS		FOOD		LEATHER		METALS IRON & STEEL		METALS NONFERROUS		METALS NOT ELSEWHERE CLASSIFIED		PETROLEUM		PRINTING		STONE, CLAY AND GLASS		WOOD		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1933	4	11.4	1	1.6	1	1.6	18	8.7	8	8.4	3	4.9			6	11.3	2	2.1	6	5.1	49	5.9
1934	4	11.4	1	1.6	1	1.6	17	8.3	8	8.4	3	4.9			4	7.6	2	2.1	5	4.3	45	5.5
1935	3	8.6	1	1.6	1	1.6	16	7.8	8	8.4	2	3.3			4	7.6	1	1.1	5	4.3	41	5.0
1936	3	8.6	1	1.6	1	1.6	15	7.3	8	8.4	2	3.3			4	7.6	1	1.1	5	4.3	40	4.8
1937	3	8.6	1	1.6	1	1.6	15	7.3	8	8.4	2	3.3			4	7.6	1	1.1	5	4.3	40	4.8
1938	3	8.6	1	1.6	1	1.6	15	7.3	6	6.3	2	3.3			4	7.6	1	1.1	4	3.4	37	4.6
1939	3	8.6	1	1.6	1	1.6	14	6.8	5	5.3	2	3.3			4	7.6	1	1.1	4	3.4	35	4.2
1940	3	8.6	1	1.6	1	1.6	12	5.8	5	5.3	2	3.3			4	7.6	1	1.1	4	3.4	33	4.0
1941	3	8.6	1	1.6	0	0.0	12	5.8	5	5.3	2	3.3			3	5.7	1	1.1	4	3.4	31	3.8
1942	3	8.6	1	1.6			12	5.8	5	5.3	2	3.3			3	5.7	1	1.1	4	3.4	31	3.8
1943	3	8.6	1	1.6			12	5.8	5	5.3	2	3.3			3	5.7	1	1.1	4	3.4	31	3.8
1944	3	8.6	1	1.6			12	5.8	5	5.3	2	3.3			3	5.7	1	1.1	4	3.4	31	3.8
1945	3	8.6	1	1.6			12	5.8	5	5.3	2	3.3			3	5.7	1	1.1	4	3.4	31	3.8
1946	3	8.6	1	1.6			12	5.8	5	5.3	2	3.3			3	5.7	1	1.1	4	3.4	31	3.8
1947	2	5.7	1	1.6			12	5.8	5	5.3	2	3.3			3	5.7	1	1.1	4	3.4	30	3.6

APPENDIX F

PERCENTAGE OF MANUFACTURING CONCERNS EXISTING IN 1873 AND WITHDRAWING EACH YEAR OF THE PERIOD 1874-1947 (BY MANUFACTURING GROUP)

Year	CHEMICALS			FOOD			LEATHER			METALS IRON & STEEL			METALS NONFERROUS			NOT ELSEWHERE CLASSIFIED			PETROLEUM			PRINTING			STONE, CLAY AND GLASS			WOOD			TOTAL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873	% of Concerns Previous Year	In 1873	In 1873																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								

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APPENDIX F (CONTINUED)
 PERCENTAGE OF MANUFACTURING CONCERNS EXISTING IN 1873 AND WITHDRAWING
 EACH YEAR OF THE PERIOD 1874-1947 (BY MANUFACTURING GROUP)

Year	CHEMICALS		FOOD		LEATHER		METALS IRON & STEEL		METALS NONFERROUS		NOT ELSEWHERE CLASSIFIED		PETROLEUM		PRINTING		STONE, CLAY AND GLASS		WOOD		TOTAL	
	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873	% of Concerns Previous Year	% of Concerns In 1873
1898	0.0	0.0	0.0	0.0	0.0	0.0	4.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	1.9	3.7	1.1	7.1	1.7	3.3	1.0
1899	0.0	0.0	4.2	1.6	0.0	0.0	3.7	1.5	7.7	2.1	0.0	0.0	0.0	0.0	0.0	0.0	7.7	2.1	3.8	.8	3.8	1.1
1900	0.0	0.0	39.1	14.3	25.0	6.4	12.7	4.9	0.0	0.0	8.3	1.6	0.0	0.0	0.0	0.0	2.5	3.2	4.0	.8	10.2	3.4
1901	0.0	0.0	0.0	0.0	0.0	0.0	13.0	4.4	4.2	1.1	0.0	0.0	0.0	0.0	7.7	1.9	9.5	2.1	8.3	1.7	6.0	1.8
1902	0.0	0.0	0.0	0.0	0.0	0.0	8.3	2.4	4.3	1.1	9.1	1.6	50.0	2.7	8.3	1.9	10.5	2.1	0.0	0.0	5.9	1.3
1903	18.2	5.7	14.3	3.2	0.0	0.0	1.8	.5	9.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	23.5	4.2	9.1	1.7	7.4	1.6
1904	0.0	0.0	0.0	0.0	0.0	0.0	3.7	1.0	15.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	1.7	4.3	.9
1905	0.0	0.0	0.0	0.0	0.0	0.0	3.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	.2
1906	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	1.6	100.0	2.7	0.0	0.0	7.7	1.1	11.1	1.7	3.3	.6
1907	0.0	0.0	0.0	0.0	8.3	1.6	2.0	.5	5.9	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	1.7	3.4	.6
1908	0.0	0.0	25.0	4.8	0.0	0.0	2.0	.5	6.7	1.1	0.0	0.0	0.0	0.0	0.0	0.0	8.3	1.1	0.0	0.0	4.2	.7
1909	0.0	0.0	22.2	3.2	0.0	0.0	4.2	1.0	7.1	1.1	11.1	1.6	0.0	0.0	0.0	0.0	9.1	1.1	7.1	.8	5.8	1.0
1910	11.1	2.9	0.0	0.0	9.1	1.6	4.3	1.0	7.7	1.1	12.5	1.6	0.0	0.0	9.1	1.9	20.0	2.1	0.0	0.0	7.0	1.1
1911	0.0	0.0	14.3	1.6	0.0	0.0	2.3	.5	15.4	2.1	0.0	0.0	0.0	0.0	10.0	1.9	0.0	0.0	0.0	0.0	4.2	.6
1912	0.0	0.0	16.7	1.6	10.0	1.6	2.3	.5	0.0	0.0	0.0	0.0	0.0	0.0	11.1	1.9	0.0	0.0	0.0	0.0	3.5	.5
1913	0.0	0.0	0.0	0.0	11.1	1.6	4.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	.8	3.6	.5
1914	12.5	2.9	0.0	0.0	12.5	1.6	2.5	.5	9.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	.8	4.7	.6
1915	14.3	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.5	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	.4
1916	0.0	0.0	0.0	0.0	14.3	1.6	2.6	.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	1.1	0.0	0.0	3.0	.4
1917	0.0	0.0	20.0	1.6	16.7	1.6	7.9	1.5	0.0	0.0	20.0	1.6	0.0	0.0	0.0	0.0	28.5	2.1	0.0	0.0	8.3	1.0
1918	0.0	0.0	0.0	0.0	0.0	0.0	2.9	.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	.1
1919	0.0	0.0	0.0	0.0	20.0	1.6	5.9	1.0	0.0	0.0	25.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	.5
1920	16.7	2.9	0.0	0.0	0.0	0.0	12.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	1.1	18.2	1.7	9.6	1.0
1921	0.0	0.0	0.0	0.0	25.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	.8	2.7	.2

APPENDIX G
THE DISTRIBUTION OF MANUFACTURING CONCERNS IN BUSINESS IN 1873 ACCORDING TO THE NUMBER
OF YEARS THEY WERE IN OPERATION BETWEEN 1873-1947 (BY MANUFACTURING GROUP)

No. of Years	CHEMICALS No. of Firms	FOOD No. of Firms	LEATHER No. of Firms	METALS		NONFERROUS No. of Firms	METALS NOT ELSEWHERE CLASSIFIED		PETROLEUM No. of Firms	PRINTING No. of Firms	STONE, CLAY AND GLASS		WOOD No. of Firms	TOTAL No. of Firms
				IRON & STEEL No. of Firms	IRON & STEEL No. of Firms		NO. of Firms	NO. of Firms			NO. of Firms	NO. of Firms		
1	4	8	9	13	4	4	6	6	4	5	9	11		73
2		3	5	15	4	4	6	6	1	5	6	9		56
3	1	4	1	7	1	1	4	4	3	2		4		27
4	2	3	7	11	4	4	2	2	4	6	9	10		58
5	2	2	1	7	4	4	1	1	4	4	5	4		34
6	1	2	2	7	4	4	2	2	2	2	1	7		30
7	1	1	2	7	3	3	2	2	5	1	3	3		28
8		3	3	5	3	3	2	2	1	3	3	3		22
9				7	5	5			1	3	4	5		25
10	1			2	1	1	4	4	2	1	1	2		13
11	1	1	1	2	1	1	3	3	1	1	1	3		14
12			4	2	1	1	3	3	1	1	1	2		14
13		2	2	1	5	5	3	3	1	1	2	4		21
14	1	2		7	4	4	2	2		1	2	4		22
15			1	2	4	4	1	1	1	3	3	3		18
16	1		3	3	3	3	1	1	2	1	1	2		16
17		1	1	5	3	3	1	1	2		3	2		18
18	1	1	1	3	4	4	2	2	1			3		16
19	4	3	1	1	3	3	2	2		1	6	1		22
20	1			3	3	3				1	1	1		10
21	1	1	2	3	1	1	1	1		1	1	2		12
22		1		4	4	4	1	1		1	1	2		14
23		1	1	2	1	1	1	1	1	1				8
24				1							4	3		8

APPENDIX G (CONTINUED)

THE DISTRIBUTION OF MANUFACTURING CONCERNS IN BUSINESS IN 1873 ACCORDING TO THE NUMBER
OF YEARS THEY WERE IN OPERATION BETWEEN 1873-1947 (BY MANUFACTURING GROUP)

No. of Years	CHEMICALS No. of Firms	FOOD No. of Firms	LEATHER No. of Firms	METALS		METALS NONFERROUS No. of Firms	NOT ELSEWHERE CLASSIFIED		PETROLEUM No. of Firms	PRINTING No. of Firms	STONE, CLAY AND GLASS		WOOD No. of Firms	TOTAL No. of Firms
				IRON & STEEL No. of Firms	IRON & STEEL No. of Firms									
61				1						2			1	4
62	1			1				1			1			4
63				1										1
64														0
65						2							1	3
66				1		1								2
67				2										2
68			1								1			2
69														0
70														0
71														0
72														0
73														0
74	1												1	1
75	2	1		12		5	2			3	1		4	30
Totals	35	63	63	206		95	61		37	53	94		118	825

APPENDIX II

THE DISTRIBUTION OF MANUFACTURING CONCERNS IN BUSINESS WITHIN THE 1856-1873 PERIOD ACCORDING TO THE NUMBER OF YEARS THEY WERE IN OPERATION BETWEEN 1856-1947 (BY MANUFACTURING GROUP)

No. of Years	CHEMICALS			FOOD			LEATHER			METALS IRON & STEEL			METALS NONFERROUS			NOT ELSEWHERE CLASSIFIED			PETROLEUM			PRINTING			STONE, CLAY AND GLASS			WOOD			TOTAL		
	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.			
1	18	100.0	51	100.0	29	100.0	116	100.0	48	100.0	41	100.0	37	100.0	36	100.0	73	100.0	113	100.0	562	100.0											
2	2	70.0	38	76.2	20	79.4	40	73.9	14	78.8	11	70.1	11	65.4	17	71.4	19	65.9	44	66.4	216	71.4											
3	3	66.7	92	58.4	15	65.2	28	64.9	13	67.2	7	62.0	10	55.1	8	57.9	9	57.0	24	53.3	138	60.5											
4	3	63.3	15	48.1	13	54.6	27	60.4	12	60.3	8	56.9	5	45.8	10	51.6	11	52.8	30	46.1	134	53.5											
5	2	58.3	9	41.1	2	45.4	11	52.5	4	54.0	8	51.1	3	41.1	7	43.7	7	47.7	8	37.2	61	46.6											
6	2	55.0	8	36.9	2	44.0	11	50.0	5	51.9	4	45.3	6	38.3	3	38.1	7	44.4	12	34.8	60	43.5											
7		51.7	7	33.2	4	42.6	11	47.5	2	49.2	3	42.3	3	32.7	4	35.7	3	41.1	3	31.2	40	40.5											
8		51.7	3	29.9	4	39.7	9	45.0	3	48.1	5	40.1	3	30.0	1	32.5	5	39.7	5	30.4	38	38.6											
9	2	51.7	4	28.5		36.9	5	43.0	3	46.6	2	36.5	4	27.1	1	31.7	3	37.4	4	28.9	28	36.5											
10	1	48.3	3	26.6	2	36.9	5	41.9	1	45.0	3	35.0	3	23.4	1	31.0	6	36.0	4	27.7	29	35.1											
11		46.7	2	25.2	2	35.5	6	40.8	3	44.4	1	32.8	2	20.6	2	30.2	3	33.2	4	26.5	25	33.6											
12	1	46.7	2	24.3	1	34.0	12	39.4	3	42.9	3	32.1	2	18.7	3	28.6	4	31.8	4	25.3	32	32.4											
13	1	45.0	2	23.4	8	33.3	5	36.7	3	41.3	2	32.1	2	16.8	1	26.2	2	29.9	4	24.1	30	30.7											
14	1	43.3	2	22.4	2	27.7	4	35.6	2	39.7	3	30.7	1	15.0	2	25.4	4	29.0	5	22.9	26	29.2											
15		41.6	3	21.5	3	26.2	3	34.7	3	38.6	2	28.5	1	14.0	1	23.8	1	27.1	2	21.4	19	27.9											
16		41.6	3	20.1	3	24.1	5	34.0	6	37.0	1	27.0	1	13.1	1	23.0	1	26.6	5	20.8	26	26.9											
17	1	41.6	2	18.7	1	22.0	4	32.9	3	33.9	4	26.3	12	12.1	2	22.2	1	26.2	2	19.3	17	25.6											
18	1	40.0	2	17.8	1	21.3	5	32.0	4	32.3	1	23.4	2	12.1	2	22.2	1	26.2	3	18.7	22	24.7											
19	1	38.3	1	16.8	1	20.6	3	30.9	3	30.2	1	22.6	2	10.3	1	20.6	3	25.7	2	17.9	17	23.6											
20	1	36.6		16.4	1	19.9	1	30.2	3	28.6		22.6	1	8.4	1	19.8	1	24.3	3	17.3	12	22.8											
21		35.0		16.4	4	19.1	4	30.0	3	27.0		22.6	1	7.5	3	19.0	2	23.8	3	16.4	20	22.2											
22	2	35.0		16.4		16.3	4	29.7	3	25.4	1	22.6	1	6.5	3	16.7	1	22.9	3	15.5	18	21.1											
23	1	31.7	3	16.4		16.3	2	28.2	2	23.8	1	21.9	5	5.6	1	14.3	1	22.4	2	14.6	11	20.2											
24		30.0	2	15.0	1	16.3	2	27.7	2	23.8	3	21.2	2	5.6	1	13.5	2	22.0	3	14.0	17	19.7											
25	2	30.0	2	14.0	2	15.6	2	27.3	1	22.8	1	19.0	1	3.7	1	13.5	2	21.0	1	13.1	15	18.8											
26	1	26.7		13.1		14.2	4	26.8	4	22.2		18.2	2.8	12.7	4	20.1	2	12.8	15	18.0													

(Continued on next page)

	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	Totals	60	
	1		10.0																			1																
			8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	5.0	5.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
			2	1																																		
			2.8	1	2																																	
			7.2	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	4.8	4.8	4.8	4.8	4.8	4.8	4.0	4.0	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
			3.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
			5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	4.8	4.8	4.8	4.8	4.8	4.8	4.0	4.0	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
			1																																			
			2.3	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.4	1.4	1.4	1.4	1.4	.9	.9	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	
			1																																			
			3.0	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	
			6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
			4.3	4.0	3.8	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	

1968 336 214 126 107 137 189 444 141 214 1968

APPENDIX I

THE DISTRIBUTION OF MANUFACTURING CONCERNS IN BUSINESS WITHIN THE 1856-1873 PERIOD ACCORDING TO THE NUMBER OF YEARS THEY WERE IN OPERATION BETWEEN 1792-1947 (BY MANUFACTURING GROUP)

No. of Years	CHEMICALS		FOOD		LEATHER		METALS IRON & STEEL		METALS NONFERROUS		NOT ELSEWHERE CLASSIFIED		PETROLEUM		PRINTING		STONE, CLAY AND GLASS		WOOD		TOTAL	
	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.
1	17	100.0	47	100.0	29	100.0	111	100.0	47	100.0	41	100.0	37	100.0	33	100.0	68	100.0	110	100.0	540	100.0
2	3	71.7	38	78.0	19	79.4	35	75.0	14	75.1	10	70.1	11	65.4	16	73.8	16	68.2	40	67.3	205	72.6
3	1	66.7	19	60.3	14	66.0	24	66.4	11	67.7	7	62.8	10	55.1	5	61.1	10	60.7	21	55.4	122	62.1
4	2	65.0	12	51.4	6	56.0	19	61.0	9	61.9	4	57.7	5	45.8	5	57.1	9	56.1	23	49.1	94	55.9
5	2	61.7	8	45.8	1	51.8	12	56.8	4	57.1	8	54.7	4	41.1	8	53.2	6	51.9	9	42.3	62	51.2
6	2	58.3	7	42.1	4	51.1	11	54.1	4	55.0	3	50.4	6	37.4	3	46.8	7	49.1	12	39.6	59	48.0
7		55.0	6	38.8	4	48.2	11	51.8	1	52.9	3	46.7	3	31.8	4	44.4	4	45.8	2	36.0	38	45.0
8		55.0	3	36.0	4	45.4	6	49.1	4	52.4	6	44.5	3	29.0	1	41.3	7	43.9	7	35.4	41	43.1
9	2	55.0	7	34.6	4	47.7	4	50.3	4	50.3	3	40.1	4	26.2	2	40.5	3	40.7	3	33.3	32	41.0
10		51.7	4	31.3	3	42.6	5	46.8	2	48.1	4	38.0	3	22.4	2	38.9	3	39.3	6	32.4	32	39.4
11		51.7	3	29.4	2	40.4	8	45.7	3	47.1		35.0	2	19.6	2	37.3	2	37.9	7	30.6	29	37.8
12	1	51.7	2	28.0	2	39.0	13	43.9	3	45.0		35.0	2	17.8	2	35.7	4	36.9	4	28.6	33	36.3
13	1	50.0	4	27.1	5	37.6	6	41.0	3	43.9		35.0	1	15.9	2	34.1	4	35.0	5	27.4	31	34.6
14	1	48.3	1	25.2	2	34.0	5	39.6	2	42.3	4	35.0		15.0	2	32.5	6	33.2	4	25.9	27	33.0
15		46.7	4	24.8	2	32.6	5	38.5	3	41.3	1	32.1	1	15.0	2	31.0	3	30.4	4	24.7	25	31.7
16		46.7	4	22.9	6	31.2	4	37.4	6	39.7		31.4	1	14.0	1	29.4	1	29.0	5	23.5	28	30.4
17	1	45.0	2	21.0	1	27.0	2	36.5	3	36.5	5	27.8		13.1	1	28.6		28.6	5	22.0	20	29.0
18		45.0	1	20.1	1	26.2	4	36.0	4	34.9	1	27.8	2	13.1	2	27.8	2	28.6	4	20.5	21	27.9
19		45.0	1	19.6		25.6	4	35.1	5	32.8	1	27.0	2	11.2	3	26.2	2	27.6	1	19.3	19	26.9
20	2	45.0	1	19.2	1	25.6	3	34.2	3	30.2		26.3	1	9.3	1	23.8	1	26.6	2	19.0	15	25.9
21	1	41.7	1	18.7	3	24.8	4	33.6	4	28.6	1	26.3	1	8.4	3	23.0	1	26.2	4	18.5	23	25.2
22	1	40.0		18.2	1	22.7	2	32.7	3	26.5	1	25.5	1	7.5	4	20.6	1	25.7	3	17.3	17	23.7
23	1	38.3	3	18.2	1	22.0	6	32.0	3	24.9	1	23.8	1	6.5	1	17.5	2	25.2	3	16.4	19	22.8
24	1	36.7	2	16.8	2	21.3	2	30.9	2	24.9	2	24.1	2	5.6		16.7	2	24.3	4	15.5	19	21.8

25	2	35.0	1	15.9	2	19.9	2	30.4	1	23.8		22.6	1	3.7	1	16.7	1	23.4		14.3	11	21.2
26	2	31.7	1	15.4		18.4	2	30.0	3	23.3		22.6		2.8		15.9	2	22.9	3	14.3	14	20.6
27	1	28.3	3	15.0		18.4	7	29.5	4	21.7	2	21.9		2.8	1	15.9	5	22.0	1	13.4	24	19.9
28		26.7	2	12.6		18.4	3	27.9	2	18.5	2	20.4		2.8	3	15.1	1	19.6	3	13.1	17	18.7
29	1	26.7	1	13.6		17.7	6	27.3		18.5	1	19.0	1	2.8		12.7	1	19.2	1	12.2	12	17.8
30	1	25.0	1	12.1		17.7	2	25.9	1	18.5	1	18.2		1.9	1	12.7	1	18.7	2	11.9	12	17.2
31		23.3	4	11.7		16.3	6	25.4	1	18.0	1	17.5	1	1.9		11.9	1	18.2	3	11.3	17	16.6
32	1	23.3	1	9.8		16.3	2	24.1	2	17.5		17.0		.9		11.9	1	17.8	1	10.4	9	15.8
33		21.7	1	9.3		14.9	4	23.9	1	16.4		17.0		.9	1	11.9		17.3		10.1	7	15.3
34	1	21.7	1	8.9		14.9	2	23.0	3	15.9	2	17.0		.9	1	11.1	2	17.3		10.1	12	14.8
35		20.0		8.4		14.9	7	22.5	1	14.3	1	15.3		.9	1	10.3	1	16.4	2	10.1	11	14.8
36	1	20.0		8.4		14.9	3	20.9	1	13.8	1	15.3		.9	1	10.3	3	15.9	2	9.5	13	13.8
37		18.3		8.4		14.2	2	20.3	1	13.2	1	14.6		.9		9.5		14.5		8.9	5	13.1
38	1	18.3		8.4		13.5	1	19.8		12.7	1	13.9		.9		9.5		14.5	1	8.9	5	12.9
39		16.7		8.4		12.8	5	19.6		12.7	1	13.1		.9	1	9.5		14.5	5	8.6	12	12.6
40		16.7	1	8.4		12.1	5	18.5	1	12.7	1	13.1		.9		8.7	1	14.5		7.1	10	12.0
41		16.7	1	7.9		11.3	2	17.3	1	12.2	1	12.4		.9		8.7	2	14.0	1	7.1	10	11.5
42		16.7	2	7.5		9.9	1	16.9	2	11.6	1	11.7		.9		8.7	1	13.1	1	6.8	8	11.0
43	1	16.7	1	6.5		9.9	5	16.7	2	10.6		10.9		.9		8.7	2	12.6		6.5	12	10.6
44		15.0	1	6.1		9.2	3	15.5		9.5		10.9		.9		8.7	4	11.7	2	6.5	10	10.0
45		15.0		5.6		9.2	3	14.9	1	9.5	1	10.9	1	.9		8.7		9.8		5.9	6	9.5
46	1	15.0		5.6		9.2	4	14.2		9.0	2	10.2			3	8.7		9.8	1	5.9	13	9.1
47		13.3		5.6		7.8	1	13.3	1	9.0		8.8				6.3	3	9.8	1	5.7	6	8.5
48		13.3	1	5.6		7.8	2	13.1		8.5		8.8				6.3		8.4		5.4	3	8.2
49	1	13.3		5.1		7.8	2	12.6	1	8.5	1	8.8				6.3	2	8.4	1	5.4	9	8.0
50		11.7		5.1		7.1	2	12.2		7.9	2	8.0				6.3	1	7.5	1	5.1	6	7.6
51		11.7	1	5.1		7.1	2	11.7		7.9	2	6.6				6.3	1	7.0		4.8	7	7.3
52		11.7		4.7		6.4	2	11.3	1	7.9		5.1				6.3	1	6.5	2	4.8	6	6.9
53		11.7		4.7		6.4	2	10.8	1	7.4		5.1				6.3	1	6.1	1	4.2	5	6.6
54		11.7		4.7		6.4	2	10.4		6.9		5.1				6.3	1	5.6	1	3.9	5	6.4
55		11.7	1	4.7		5.7	1	9.9		6.9		5.1				6.3		5.1		3.6	2	6.1
56		11.7	2	4.2		5.7	2	9.7		6.9		5.1		1		6.3	1	5.1	1	3.6	7	6.0
57		11.7	1	3.3		5.7		9.2		6.9		5.1				5.5	1	4.7		3.3	2	5.6
58		11.7		2.8		5.7		9.2		6.9		5.1				5.5	1	4.2		3.3	5	5.5
59	1	10.0		2.8		3.5	2	9.2		6.9		5.1				5.5		3.7		3.3	4	5.3
60		10.0	1	2.8		2.1	2	8.9		6.9	1	5.1				5.5		3.7		3.3	4	5.1

(Continued on next page)

APPENDIX I (CONTINUED)

THE DISTRIBUTION OF MANUFACTURING CONCERNS IN BUSINESS WITHIN THE 1856-1873 PERIOD ACCORDING TO THE NUMBER OF YEARS THEY WERE IN OPERATION BETWEEN 1792-1947 (BY MANUFACTURING GROUP)

No. of Years	CHEMICALS No. of Firms	FOOD No. of Firms	LEATHER No. of Firms	METALS		METALS NONFERROUS		NOT ELSEWHERE CLASSIFIED		PETROLEUM		PRINTING		STONE, CLAY AND GLASS		WOOD		TOTAL No. of Firms
				No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	No. of Firms	% Accum.	
61		10.0	2	2.3	2.1	2	8.3	6.9	4.4			5.5	3.7	1	3.3	5	4.9	
62	1	10.0	1.4	1.4	2.1	2	7.9	6.9	4.4			5.5	3.7	1	3.0	4	4.6	
63		8.3	1.4	1.4	2.1	2	7.4	6.9	4.4			5.5	3.7	1	2.7	3	4.4	
64		8.3	1.4	1.4	2.1	2	7.0	6.9	4.4			5.5	3.7		2.4	2	4.3	
65		8.3	1.4	1.4	2.1		6.5	1	4.4			5.5	3.7		2.4	1	4.2	
66		8.3	1.4	1.4	2.1		6.5	6.3	4.4			5.5	3.7		2.4		4.1	
67		8.3	1.4	1.4	2.1	1	6.5	6.3	1	4.4		5.5	3.7	1	2.4	3	4.1	
68		8.3	1.4	1.4	2.1		6.3	6.3	3.6	3.6		5.5	3.7	2	2.1	3	4.0	
69		8.3	1.4	1.4	1.4	1	6.3	1	3.6	3.6		5.5	3.7		1.5	2	3.8	
70		8.3	1.4	1.4	1.4		6.1	5.8	3.6	3.6	1		3.7		1.5	1	3.7	
71		8.3	1.4	1.4	1.4		6.1	1	3.6	3.6		4.8	3.7		1.5	1	3.7	
72		8.3	1.4	1.4	1.4	1	6.1	5.3	3.6	3.6		4.8	3.7		1.5	1	3.6	
73		8.3	1	1.4	1.4	2	5.9	5.3	3.6	3.6		4.8	1	3.7	1.5	4	3.6	
74		8.3	.9	1.4	1.4	1	5.4	1	3.6	3.6	2	4.8	2	3.3	1.5	4	3.4	
75		8.3	.9	1.4	1.4		5.2	4.8	3.6	3.6		4.8		2.3	1.5	1	3.2	
76		8.3	.9	1	1.4	2	5.0	4.8	3.6	3.6		4.8		2.3	1.5	3	3.1	
77	1	8.3	.9	.9	.7		4.5	4.8	1	3.6	1	4.8	1	2.3	1.5	4	2.9	
78		6.7	1	.9	.7	1	4.5	1	2.9	2.9		4.0	1	2.3	1.2	4	2.7	
79		6.7	1	.5	.7	1	4.3	4.2	2.9	2.9		4.0		1.9	1.2	3	2.5	
80		6.7				1	4.1	4.2	1	2.9		4.0		1.9	1.2	3	2.4	
81		6.7				1	3.8	4.2	2.2	2.2		4.0		1.9	.9	1	2.2	
82	1	6.7					3.6	1	4.2	1	2.2	4.0		1.9	.9	3	2.2	
83		5.0					3.6	1	3.6	1	1.5	4.0	1	1.9	.9	4	2.0	
84		5.0				1	3.6	3.2	.7	.7		3.2		1.4	.9	1	1.8	

85	5.0	1	3.4	3.2	.7	3.2	3.2	1.4	.9	1	1.8
86	5.0	2	3.2	3.2	.7	3.2	3.2	1.4	.9	3	1.7
87	5.0	2	2.7	3.2	.7	3.2	3.2	.9	.9	3	1.6
88	5.0		2.3	1	.7	3.2	3.2	.5	.9	3	1.4
89	5.0	1	2.3	3.2	.7	3.2	3.2	.5	.3	1	1.3
90	5.0	1	2.0	2.6	.7	3.2	3.2	.5	.3	1	1.2
91	5.0	1	1.8	2.6	.7	3.2	3.2	.5	.3	1	1.2
92	3.3	2	1.8	2.6	.7	3.2	3.2	.5	.3	3	1.1
93	3.3		1.4	2.6	.7	2.4	2.4	.5	.3		1.0
94	3.3		1.4	2.6	.7	2.4	2.4	.5	.3		1.0
95	3.3		1.4	2.6	.7	2.4	2.4	.5	.3		1.0
96	3.3	1	1.4	2.6	.7	2.4	2.4	.5	.3	2	1.0
97	1.7		1.1	2.6	1	2.4	2.4	.5	.3	1	.9
98	1.7	1	1.1	2.6	.7	2.4	2.4	.5	.3	1	.8
99	1.7		.9	2.6		2.4	2.4	.5	.3	2	.8
100		1	.9	2.1		2.4	2.4	.5	.3	2	.7
101			.9	2.1		2.4	2.4	.6	.6		.6
102		1	.9	2.1		2.4	2.4		1	1	.6
103		1	.7	2.1		2.4	2.4			1	.5
104			.4	2.1		2.4	2.4			1	.5
108			.4	2.1		2.4	2.4			1	.4
109			.4	2.1	1	1.6	1.6			1	.4
110			.4	1.6	1	1.6	1.6			1	.3
111			.4	1.1		1.6	1.6			1	.3
112			.4	1.1		1.6	1.6			1	.3
113			.4	.5		1.6	1.6			1	.2
116			.4	.5		1.6	1.6			1	.2
117			.4			1.6	1.6			1	.2
129			.4			1.6	1.6			1	.2
130		1	.4			.8				2	.15
146		1	.2							1	.05
Totals	60	444	189	137	107	126	214	336	1988		

APPENDIX J
THE DISTRIBUTION OF MANUFACTURING CONCERNS, ACCORDING TO THEIR AGE AND
MANUFACTURING GROUP, WHICH WERE AT LEAST 75 YEARS OLD IN 1947

Years of Age	CHEMICALS No. of Accum. Concerns Total	FOOD No. of Accum. Concerns Total	LEATHER No. of Accum. Concerns Total	METALS IRON & STEEL No. of Accum. Concerns Total	METALS NONFERROUS No. of Accum. Concerns Total	NOT ELSEWHERE CLASSIFIED No. of Accum. Concerns Total	PETROLEUM No. of Accum. Concerns Total	PRINTING No. of Accum. Concerns Total	STONE, CLAY AND GLASS No. of Accum. Concerns Total	WOOD No. of Accum. Concerns Total	TOTAL No. of Accum. Concerns Total
75	2	1	0	12	5	2	0	3	1	4	30
76	2	1		12	5	2		3	1	4	30
77	1	1		12	5	2		1	1	4	30
78	1	1		12	5	2		2	1	4	28
79	1	1		12	5	2		2	1	4	28
80	1			11	5	2		2	1	4	26
81	1			10	5	2		2	1	3	24
82	1			9	5	2		2	1	3	23
83	1			9	5	1		2	1	3	23
84	1			9	5	1		2		3	21
87	1			8	5	1		2		3	20
88	1			7	5	1		2		3	19
90	1			7	4	1		2		1	16
92	1			6	4	1		2		1	15
96	1			4	4	1		1		1	12
97				3	4	1		1		1	10
100				3	4			1		1	9
102				3	4			1		1	8
109				2	4			1		1	7
110				2	3			1		1	6
112				2	2			1		1	5
116				2	2			1		1	4
130				2	1			1		2	3
146				1	1			1		1	1

APPENDIX K

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
CHEMICAL GROUP AND THE TOTAL NUMBER OF FIRMS RECORDED
EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>	<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....	15
1857	3	20.0	2	13.3	16
1858	4	25.0	0	0.0	20
1859	1	5.0	3	15.0	18
1860	3	1.7	4	2.2	17
1861	0	0.0	1	5.9	16
1862	1	6.25	0	0.0	17
1863	2	11.8	0	0.0	19
1864	0	0.0	1	5.3	18
1865	1	5.5	0	0.0	19
1866	3	15.8	1	5.3	21
1867	3	14.3	2	9.5	22
1868	4	18.2	1	4.5	25
1869	1	4.0	2	8.5	24
1870	7	29.2	1	4.2	30
1871	5	16.7	2	9.7	33
1872	4	12.1	2	6.0	35
1873	3	8.6	3	8.6	35

APPENDIX L

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
FOOD GROUP AND THE TOTAL NUMBER OF FIRMS RECORDED
EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		<i>Number</i>	EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>		<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....		49
1857	23	46.9	13	26.5		59
1858	19	32.2	3	5.1		75
1859	12	16.0	7	9.3		80
1860	2	2.5	42	51.2		40
1861	5	12.5	6	15.0		39
1862	3	7.7	2	5.1		40
1863	9	22.5	4	10.0		45
1864	9	20.0	8	17.8		46
1865	3	6.5	2	4.3		47
1866	4	8.5	3	6.4		48
1867	9	18.7	3	6.2		54
1868	12	22.2	9	16.7		57
1869	15	26.3	5	8.8		67
1870	10	14.9	8	11.9		69
1871	14	20.3	9	13.0		74
1872	15	20.3	11	14.9		78
1873	1	1.3	16	17.5		63

APPENDIX M

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
LEATHER GROUP AND THE TOTAL NUMBER OF FIRMS RECORDED
EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>	<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....	26
1857	8	30.8	1	3.8	33
1858	5	15.2	2	6.1	36
1859	4	11.1	2	5.5	38
1860	1	2.6	18	47.4	21
1861	3	14.3	1	4.8	23
1862	2	8.7	1	4.3	24
1863	4	16.7	3	12.5	25
1864	3	12.0	2	8.0	26
1865	3	11.5	1	3.8	23
1866	3	10.7	0	0.0	31
1867	10	3.2	2	6.5	39
1868	19	48.7	7	17.9	51
1869	14	27.5	11	21.6	54
1870	12	22.2	8	14.8	58
1871	14	24.1	14	24.1	58
1872	4	6.9	4	6.9	58
1873	6	10.3	1	1.7	63

APPENDIX N

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
METALS, IRON & STEEL GROUP AND THE TOTAL NUMBER OF
FIRMS RECORDED EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>	<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....	124
1857	3	2.4	10	8.1	117
1858	21	17.9	5	4.3	133
1859	10	7.5	14	10.5	129
1860	8	6.2	28	21.7	109
1861	8	7.3	1	.1	116
1862	10	8.6	3	2.6	123
1863	22	17.9	9	7.3	136
1864	22	16.2	10	7.4	148
1865	17	11.5	7	4.7	158
1866	16	10.1	8	5.1	166
1867	16	9.6	15	9.0	167
1868	32	19.8	18	10.8	181
1869	24	13.3	13	7.2	192
1870	35	18.2	17	8.9	210
1871	36	17.1	25	11.9	221
1872	20	9.2	26	11.8	215
1873	20	9.3	29	13.5	206

APPENDIX O

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
METALS, NONFERROUS GROUP AND THE TOTAL NUMBER OF
FIRMS RECORDED EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>	<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....	34
1857	6	17.6	2	5.9	38
1858	13	34.2	2	5.3	49
1859	10	20.4	10	20.4	49
1860	1	2.0	14	28.6	36
1861	6	16.7	2	5.5	40
1862	4	10.0	3	7.5	41
1863	4	9.8	2	4.9	43
1864	4	9.3	2	4.7	45
1865	6	13.3	2	4.4	49
1866	6	12.2	3	6.1	52
1867	17	32.7	0	0.0	69
1868	27	39.1	11	15.9	85
1869	14	16.5	12	14.1	87
1870	2	2.3	9	10.3	80
1871	14	16.7	4	5.0	90
1872	13	14.0	11	12.1	92
1873	8	8.7	5	5.4	95

APPENDIX P

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
PETROLEUM GROUP AND THE TOTAL NUMBER OF FIRMS RECORDED
EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>	<i>Number</i>	<i>Percentage</i>	
1856	..	.....	..	....	1
1857	..	.....	..	....	1
1858	2	200.0	..	....	3
1859	3	100.0	..	....	6
1860	1	16.7	2	33.3	5
1861	2	40.0	0	0.0	7
1862	13	186.0	0	0.0	20
1863	6	30.0	4	20.0	22
1864	10	45.4	2	9.1	30
1865	8	26.7	5	16.7	33
1866	5	15.1	7	21.2	31
1867	3	9.7	3	9.7	31
1868	9	29.0	4	12.9	36
1869	11	30.5	7	19.4	40
1870	7	17.5	8	20.0	39
1871	11	28.2	8	20.5	42
1872	8	19.0	11	26.2	39
1873	7	17.9	9	23.1	37

APPENDIX Q

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
PRINTING GROUP AND THE TOTAL NUMBER OF FIRMS RECORDED
EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>	<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....	35
1857	1	2.9	10	28.6	26
1858	6	23.1	2	7.7	30
1859	2	6.7	4	13.3	28
1860	1	3.6	9	32.1	20
1861	4	20.0	3	15.0	21
1862	4	19.0	3	14.3	22
1863	2	9.1	1	18.2	23
1864	1	4.3	0	0.0	24
1865	2	8.3	3	12.5	23
1866	6	26.1	0	0.0	29
1867	4	13.8	4	13.8	29
1868	14	48.3	2	6.9	41
1869	8	19.5	11	26.8	38
1870	13	34.2	5	13.2	46
1871	10	21.7	3	6.5	53
1872	9	17.9	7	13.2	55
1873	4	7.3	6	10.9	53

APPENDIX R

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
STONE, CLAY & GLASS GROUP AND THE TOTAL NUMBER OF
FIRMS RECORDED EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		<i>Number</i>	EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>		<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....		46
1857	3	6.5	7	15.2		42
1858	4	9.5	2	4.8		44
1859	12	27.3	4	9.1		52
1860	6	11.5	14	26.9		44
1861	4	9.5	4	9.5		44
1862	4	9.5	3	6.8		45
1863	10	22.2	2	4.4		53
1864	4	7.5	7	13.2		50
1865	7	14.0	4	8.0		53
1866	10	18.9	7	13.2		56
1867	9	16.1	2	3.6		63
1868	15	23.8	7	11.1		71
1869	22	31.0	9	12.7		84
1870	20	23.8	13	15.5		91
1871	11	12.1	14	15.4		88
1872	14	15.9	15	17.0		87
1873	13	14.9	6	6.9		94

APPENDIX S

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
WOOD GROUP AND THE TOTAL NUMBER OF FIRMS RECORDED
EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>	<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....	69
1857	8	11.6	8	11.6	69
1858	13	18.8	5	7.2	77
1859	24	31.2	15	19.5	86
1860	8	9.3	46	53.5	48
1861	10	20.8	3	6.3	55
1862	5	9.1	9	16.4	51
1863	13	25.5	4	7.8	60
1864	11	18.3	3	5.0	68
1865	8	11.8	7	10.3	69
1866	10	14.5	10	14.5	69
1867	21	30.4	0	0.0	90
1868	17	18.9	16	17.8	91
1869	20	22.0	9	9.9	102
1870	33	32.4	5	4.9	130
1871	34	26.2	20	15.4	144
1872	22	15.3	44	30.5	122
1873	10	8.2	14	11.5	118

APPENDIX T

NUMBER AND PERCENTAGE OF ENTRANCES AND EXITS FROM THE
NOT ELSEWHERE CLASSIFIED GROUP AND THE TOTAL NUMBER OF
FIRMS RECORDED EACH YEAR FROM 1856 TO 1873 INCLUSIVE

<i>Year</i>	ENTRANCES		<i>Number</i>	EXITS		<i>Total Number Recorded</i>
	<i>Number</i>	<i>Percentage</i>		<i>Number</i>	<i>Percentage</i>	
1856	..	....	..	....		35
1857	3	8.6	3	8.6		35
1858	4	10.4	2	5.7		37
1859	5	13.5	2	5.4		40
1860	4	10.0	13	32.5		31
1861	1	3.2	1	3.2		31
1862	2	6.4	3	9.7		30
1863	2	6.7	0	0.0		32
1864	6	18.7	3	9.4		35
1865	2	5.7	1	2.9		36
1866	4	11.1	1	2.8		39
1867	4	10.3	2	5.1		41
1868	14	34.1	1	2.4		54
1869	19	35.2	8	14.8		65
1870	14	21.5	11	16.9		68
1871	9	13.2	15	22.1		62
1872	6	9.7	4	6.5		64
1873	3	4.7	6	9.4		61

APPENDIX U

This part of the book is the recording of interviews with the personnel of the thirty concerns which succeeded in maintaining continuous production for at least seventy-five years. It should be remembered that the study ends with the year 1947, and therefore some changes may be realized before the book is published.*

The interviews were undoubtedly the most pleasant and rewarding part of the work. The individuals participating in these businesses took special pride in being part of organizations whose administrators had practiced such enlightened management that their survival was guaranteed. It was their ready co-operation that made the collecting of much of the data possible, and to them the writer wishes to express his sincere gratitude.

* Publication date, 1952, four years after study was completed.

APPENDIX U-1

<i>Name of Firm:</i>	Thompson & Company (Inc.).
<i>Address:</i>	1085 Allegheny Avenue, Oakmont, Pennsylvania.
<i>Officials Interviewed:</i>	President, Secretary.
<i>Sequence of</i>	1871, Thompson & Lyon.
<i>Trade Styles:</i>	1880, Thompson & Co. 1903, Thompson & Company (Inc.).
<i>Products:</i>	Industrial and technical paint.
<i>Division of</i>	
<i>Manufacturing:</i>	Chemicals and allied products.
<i>Net Worth Class:*</i>	\$250,000-\$500,000.
<i>Distribution:</i>	Principally to manufacturing concerns.
<i>Seasons:</i>	Sales are fairly steady throughout the year.
<i>Territory:</i>	Sales are confined mostly to the eastern part of the United States.
<i>Continuity of Control</i>	
<i>Established:</i>	1871.

Conditions Surrounding Origin:

In 1847, Eichbaum & Son established in Allegheny City the first flaxseed oil mill employing the hydraulic method of extraction west of the Alleghenies. The mill was subsequently operated by DeHaven & Son, 1852-1860, and by Euwer & Hamilton, 1861-1870. It was an economically sound enterprise. Flax, the basic raw material, was widely grown by surrounding farmers. The flax, after separation, was spun into cloth and sold back to the farmers. The flax pulp was pressed into cakes for stock feeding purposes, and the extracted linseed oil was sold to paint makers. John Thompson and William Lyon, while employed by the same dry goods firm, had saved their money in anticipation of engaging in a profitable business venture. When the business of Euwer and Hamilton became available, they decided it represented the opportunity they had been awaiting and purchased it in 1871.

* Replacement cost or sound value of working assets substantially exceeds their carrying value.

Factors Contributing to the Longevity of Any Concern Operating Under Similar Conditions:

1. Location provided proximity to sales market, raw materials, power, and labor.
2. Products have encountered a relatively steady demand which, in a few instances, has rapidly expanded.

Longevity Factors Specifically Associated with Thompson & Company:

1. Developed from original producer of its type in Allegheny County.
2. Negligible competition encountered during first 20 years of existence.
3. Favorable financial connections.
4. Previous business experience of the original owner.
5. Managerial guidance furnished by John Thompson, 1871–1900; Edward Thompson, 1901–1936; John V. Thompson, 1924–1947.
6. Birth of children, within the family, willing and capable of successfully continuing the business.
7. Advantages resulting from an established reputation.
8. The intensive training program followed by each member of the family upon entrance into the business.
9. Transfer from linseed oil to paint manufacturing.
10. Excellent employee relations.
11. Conservative operating policy controlling slow expansion and negligible withdrawal of profits.
12. Intensive research enabling frequent introduction of new products.
13. Immediate adoption of newest productive techniques and machinery permitting lowest unit production costs.
14. Production of new, unusual, and quality products to avoid extensive competition.
15. Insurance protection against fire losses.

Solutions to Conditions Severely Testing Survival Ability:

By 1890, very little flax was grown in the Allegheny County Area. Linseed oil producers, located in the Middle West and along the eastern seaboard, could secure ample flax cheaply from western farms and, by importing, from South America. The inexpensiveness of their raw materials enabled them to absorb freight costs and sell in Allegheny County at a price below local costs of production. Consequently, local concerns steadily were being forced out of the market.

The paint industry consumed the major part of the linseed oil manufacturers' production; so Thompson & Co. was well acquainted with conditions confronting the manufacturers of paint. Since the industry appeared to be facing a favorable future, it seemed wise to switch from linseed oil to paint manufacturing. Replacing linseed oil production with paint manufacturing enabled the company to return to profitable operations.

APPENDIX U-2

<i>Name of Firm:</i>	Strunz Soap Company (Inc.).
<i>Address:</i>	702-18 Bingham St., Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President.
<i>Sequence of Trade Styles:</i>	1852, S. Strunz. 1869, Strunz & Wenzel. 1884, Stephen Strunz. 1888, S. Strunz & Son. 1923, Strunz & Sons, Inc. 1946, Strunz Soap Co. (Inc.).
<i>Products:</i>	Soap, poultry feed, glycerine, and fertilizer.
<i>Division of Manufacturing:</i>	Chemicals and allied products.
<i>Net Worth Class:</i>	Not determinable; believed \$250,000-\$500,000
<i>Distribution:</i>	Approximately 50 per cent of the total sales are made to various retailers. The remaining 50 per cent are made by house to house representatives.
<i>Territory:</i>	Pittsburgh and vicinity, within a radius of approximately 300 miles.
<i>Seasons:</i>	Fairly steady throughout the year.
<i>Continuity of Control Established:</i>	1852 is the earliest date substantiated by historical references. The firm considers 1850 as its date of origin.

Conditions Surrounding Origin:

Stephen Strunz, German born, arrived in America shortly before his business was established in Allegheny County. In Germany he participated in the soap manufacturing business which was operated by his family. His experience there provided him with valuable soap formulas and a thorough knowledge of how the business operated. The quality of the soap he encountered upon arriving in Pittsburgh was inferior to that which he had helped produce in Germany. Therefore, Allegheny County appeared to be a favorable location for the use of the capital, soap formulas, and skill he had brought from Germany. So the Strunz Soap Company was founded.

Factors Contributing to the Longevity of any Concern Operating Under Similar Conditions:

1. Location provided isolation from soap manufacturers and proximity to a sales market in a large center of population, abundant raw materials, and adequate power and labor.
2. Demand has constantly expanded.

Longevity Factors Specifically Associated with Strunz Soap Co.:

1. Previous business experience of founder.
2. Superiority of product during infancy of the business.
3. Managerial guidance furnished by Stephen Strunz, 1882-1890; E. J. McGrael, 1928.
4. Control resulting from patents secured by Stephen C. Strunz.
5. Heavy reinvestment of profits during 1850-1890 and 1920-1930.
6. Avoiding over-expansion by greatest efficiency from capacity.
7. Flexibility of operation keeping firm readily adaptable to product or distribution changes.
8. Favorable labor relations.
9. Concentrated sales territory permitting expansion during the great depression into previously unexplored markets.
10. Avoiding competition with large volume-low priced products through manufacturing of high quality, high priced goods.
11. Minimizing advertising costs by substituting direct home consumption for participation in the advertising race commenced by large manufacturers of soap in the early 1920's.
12. Favorable financial connections during past 25 years.

Solutions of Conditions Severely Testing Survival Ability:

The company has never had its survival ability severely tested. The records of the company indicate that prior to 1914 the volume of business was very small and though the net income was also very small, there never was a time when there was a question of ability to meet all obligations promptly. The 1914-1918 period brought high prices and an increase in net income. Sales, prices, and net income declined in 1919 and 1920. In 1920 the organization of direct selling increased sales and there has been a steady expansion since 1920.

Reserves had been accumulated in the 1914-1918 period and in spite of the drop in sales in 1919 and 1920, there never was any question of ability to meet all obligations. The company has gone through periods of depressed business, but could have liquidated at any time with no injury to any creditor.

APPENDIX U-3

<i>Name of Firm:</i>	H. J. Heinz Company.
<i>Address:</i>	1002 Progress Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Advertising Manager, Public Relations Manager, and Representatives of Public Relations Counseling Firm.
<i>Sequence of</i>	1869, F. & J. Heinz.
<i>Trade Styles:</i>	1888, H. J. Heinz & Co. 1900, H. J. Heinz Company.
<i>Products:</i>	Foods: processed, preserved, and packed.
<i>Division of</i>	
<i>Manufacturing:</i>	Foods and allied products.
<i>Net Worth Class:</i>	\$25,000,000 and over.
<i>Distribution:</i>	Originally door-to-door neighborhood sales followed by sales to independent stores, supermarkets, chain stores, hotels, and restaurants.
<i>Territory:</i>	Throughout the United States, Canada, the British Isles, and Australia.
<i>Seasons:</i>	Subject to high seasonal variations during early years, but improved processing and preserving methods combined with world wide operations have eliminated seasonal maladjustment.
<i>Continuity of Control</i>	
<i>Established:</i>	1869.
<i>Conditions Surrounding Origin:</i>	
In 1869, H. J. Heinz started growing horseradish in a three-quarter acre patch in Sharpsburg, Pennsylvania. He placed his horseradish in clear glass bottles and sold it to nearby housewives. His product became popular immediately, so he added chow chow and various types of pickles and pickled onions to his food line.	
<i>Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:</i>	
1. Location provided proximity to sales market, raw materials, transportation, power, and labor.	
2. Product originally faced an undeveloped demand; also, product demand has expanded constantly.	

Longevity Factors Specifically Associated with H. J. Heinz Company:

1. Timeliness of origin. (Although Pasteur, in 1860, dealt the final blow to the then tottering theory of spontaneous generation, the Civil War proved the practicability of canned goods.)
2. Previous training of the founder.
3. Managerial guidance furnished from 1869 to 1919 by H. J. Heinz, a combination of salesman, advertising man, research scientist, and financier; Howard Heinz, 1919-1941; and H. J. Heinz II, 1941.
4. Birth of children, within the family, willing and capable of successfully continuing the firm.
5. Employment of capable administrators to augment the guidance furnished by the controlling interest.
6. Advantage resulting from an established reputation and widespread customer confidence toward the company's brand names.
7. The introduction of clear glass bottle containers for canned foods.
8. Launching of expansion programs during periods of depression.
9. Revolutionizing the preparation and serving of soup in small eating places by introducing Heinz Soup Kitchens.
10. Leadership of H. J. Heinz and Dr. Harvey Wiley in the successful fight for the enactment of the Federal Pure Food Law.
11. Expanding the company's line to include many types of canned foods to stabilize demand variation with product diversification.
12. Marketing procedure. (Middlemen are eliminated by the company's selling directly to groceries, hotels, and restaurants.)
13. Extensive advertising.
14. Early introduction and continued operation of an intensive research and quality control department.
15. Control of raw materials with company owned facilities and numerous contract farmers.
16. Intentional preparation of family members for entrance into the business.
17. Maintaining superior quality of product.
18. Acquiring and operating any facility which could be profitably maintained.
19. Reinvestment of profits into business for expansion.
20. Excellent labor relations.

Solutions of Conditions Severely Testing Survival Ability:

None discovered.

APPENDIX U-4

<i>Name of Firm:</i>	A. M. Byers Company (Inc.).
<i>Address:</i>	Clark Building, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Vice-President and Comptroller.
<i>Sequence of</i>	1864, Graff, Byers & Co.
<i>Trade Styles:</i>	1870, Byers, McCullough & Co. 1876, A. M. Byers & Co. 1878, A. M. Byers & Company (Inc.). 1903, A. M. Byers Company (Inc.).
<i>Products:</i>	Wrought iron, tubular products, wrought iron flat rolled products, electric furnace quality carbon and alloy steels.
<i>Division of</i>	
<i>Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$10,000,000-\$25,000,000.
<i>Distribution:</i>	Sales are largely through jobbers, and to a lesser extent directly to industrials and railroads.
<i>Territory:</i>	Entire United States, and some foreign markets.
<i>Seasons:</i>	Comparatively steady throughout the year.
<i>Continuity of Control</i>	
<i>Established:</i>	1864.

Conditions Surrounding Origin:

In 1864 the Civil War had created an unprecedented demand for iron and iron products. Joseph Graff and A. M. Byers, both thoroughly familiar with the production of iron and having access to the necessary capital, formed a partnership which acquired a small iron rolling mill and commenced the manufacture of iron and iron products.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor.
2. Product has experienced a long term expanding demand. Demand was largely undeveloped at inception of the company.

Longevity Factors Specifically Associated with A. M. Byers Company:

1. Previous experience of the founders.
2. Managerial guidance furnished by A. M. Byers, his sons and grandsons, 1864–1947; Leon F. Rains, 1931.
3. Only local concern manufacturing galvanized iron pipe during the 1880's.
4. Favorable financial connections throughout entire history of the company.
5. Raw materials controlled by ownership of Girard Iron Co., 1880–1939, Orient Coal and Coke Co. 1925–1947, and interest in iron ore mines at Lake Superior acquired in the 1870's.
6. Birth of children within the controlling family willing and capable of successfully continuing the business.
7. Employment of capable executives to augment the guidance furnished by the controlling interest.
8. Advantage resulting from an established reputation.
9. Family desire to perpetuate the firm, resisting many attractive merger propositions between 1890–1910.
10. Patent control over the Aston Mechanical Process for the manufacture of wrought iron, enabling the company to replace the more costly hand puddling process with a new mechanical plant in 1931. (Dr. James Aston, a company employee, developed a new metallurgical and mechanical process for making wrought iron in 1916. A. M. Byers and Company's experiment with a pilot plant proved the practicability of the new process.)
11. Continual confidence in wrought iron, after most competitors had transferred to steel, placing the company in a position to assume leadership in the industry.
12. The policy of buying, producing, and expanding during depressions. (In 1893 A. M. Byers produced pig iron to keep his plant running at capacity. He persuaded employees to accept token wages with a claim for future additional payment and produced all the iron and pipe he could adequately store. When the panic broke, he was the only pipe manufacturer having a substantial supply of finished pipe. Consequently his stock was rapidly disposed of at highly profitable prices. Similar methods have been employed in subsequent depressions.)
13. Steady expansion largely financed through reinvestment of profits.

14. A conservative operating policy avoiding "diseconomies" of size exceeding the availability of adequate supervisions.

Conditions Severely Testing Survival Ability and Their Solutions:

Survival ability has never been severely tested; however, two difficult periods have been experienced:

1. The making of steel by the Bessemer Process enabled the volume production of pipe from steel at a much lower cost than it could be made from wrought iron, and steel pipe was gradually replacing wrought iron pipe. This replacement was retarded by the superior resistance of wrought iron pipe against corrosion, but by 1910, A. M. Byers & Co. was definitely suffering from decreased sales volume. Business continued to slump until 1914 when the demand created by the first World War replaced the volume which had been lost to steel pipe. The development of the Aston process helped the company to compete successfully with steel pipe after the termination of the demand created by the war.
2. The depression of the 1930's greatly reduced the demand for wrought iron products. After filling available storage space with finished materials, operations were cut to a minimum. Production fell as low as 10 per cent of practical capacity, and losses were sustained from 1931 through 1936. An excellent financial position enabled the company to survive this period with only occasional short-term bank loans and no recourse to long-term financing.

APPENDIX U-5

<i>Name of Firm:</i>	Hubbard & Company, Inc.
<i>Address:</i>	6301 Butler Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President.
<i>Sequence of Trade Styles:</i>	1846, Lippincott & Co. 1865, Lippincott & Bakewell. 1870, Hubbard, Bakewell & Lippincott. 1873, Hubbard, Bakewell & Co. 1886, Hubbard & Co. 1896, Hubbard & Co., Inc.
<i>Products:</i>	A line of heavy hardware, including galvanized pole line, hardware, railroad track tools, mining tools, aluminum products, and farm implements such as racks, cultivators, etc. Principal products until 1900 were axes, saws, and shovels.
<i>Division of Manufacturing:</i>	Iron, steel, aluminum and their products.
<i>Net Worth Class:</i>	\$10,000,000—\$25,000,000.
<i>Distribution:</i>	Sales are made to wholesale electrical supply concerns, wholesale hardware supply houses, public utilities, municipalities and railroads. Principal consumers throughout entire existence have been railroads and wholesale hardware houses.
<i>Territory:</i>	Shipments are made throughout the United States, Central America, and South America.
<i>Seasons:</i>	There is no seasonal effect on the business.
<i>Continuity of Control Established:</i>	1846. (Company recognizes 1843 as date of origin, but existence prior to 1846 could not be substantiated.)
<i>Conditions Surrounding Origin:</i>	Not definitely ascertained.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor.
2. Majority of products have experienced an expanding demand.

Longevity Factors Specifically Associated with Hubbard & Company, Inc:

1. Early entrance into tool manufacturing in Allegheny County.
2. Managerial guidance furnished by Charles Hubbard until 1900 and John W. Hubbard, 1900.
3. Birth of children, within the controlling family, willing and capable of successfully continuing the firm.
4. Employment of superior executive personnel to augment the guidance furnished by the controlling interest.
5. Advantages obtained from numerous patents.
6. Advantages resulting from an established reputation.
7. Maintaining superior quality of product.
8. Timely addition of new products, such as pole line hardware, railroad track tools, aluminum products, and electrical goods, to the line of goods being manufactured.
9. Liberal profit-sharing plan covering top management since 1897.
10. Maintaining adequate fire insurance protecting the company against fire losses of approximately \$810,000.
11. Highly successful labor relations. (e.g. No contract was necessary between company and union between 1940-1947.)
12. Prudent financial management has enabled the company to finance, without outside aid, the major cost of expansion. (December 31, 1946 is cited as example of its financial position. Total indebtedness, including substantial reserves for federal and state taxes, was covered approximately 1½ times by liquid assets consisting of cash and government securities.)

Solutions of Conditions Severely Testing Survival Ability:

No extremely critical period has existed. The company's operations, throughout its history, have been conducted with generally favorable results although volume has fluctuated, from time to time, in accordance with the experience of the trade, which closely follows general economic trends.

APPENDIX U-6

<i>Name of Firm:</i>	Iron City Tool Works (Inc.).
<i>Address:</i>	3201 Smallman Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President and Treasurer.
<i>Sequence of Trade Styles:</i>	1867, Kloman, Burkle & Co. 1872, Kloman, Park & Co. 1880, Hays, Park & Dalzell Co. 1890, Iron City Tool Works, Ltd. 1929, Iron City Tool Works (Inc.).
<i>Products:</i>	Complete line of forged steel tools such as picks, mattocks, hoes, sledges, bars, vises, and miscellaneous articles.
<i>Division of Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$250,000-\$500,000.
<i>Distribution:</i>	To wholesale hardware concerns, railroads, and wholesale mill and mine supply houses.
<i>Territory:</i>	Approximately 85 per cent of volume is derived from sales throughout the United States. The remaining 15 per cent is export. During first 25 years of experience sales were virtually limited to Pittsburgh and immediate vicinity.
<i>Seasons:</i>	Steady throughout the year.
<i>Continuity of Control Established:</i>	1867.

Conditions Surrounding Origin:

Railroad and industrial expansion during the reconstruction period following the close of the Civil War created a tremendous demand for forged tools. Kloman and Burkle, both experienced in the production of such tools, formed a partnership to manufacture them for the expanding market.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor.
2. Product has experienced a long-term expanding, relatively stable demand with negligible changes in design and style.

Longevity Factors Specifically Associated with Iron City Tool Works:

1. Previous experience of the founders.
2. Financing provided by D. E. Park from 1872 until business was firmly established.
3. Production supervision by J. H. Dalzell after 1880.
4. Managerial and administrative guidance by W. H. Hays who, prior to 1880, gained valuable experience while employed in an executive capacity by McCully Glass Co.
5. Birth of children within the controlling family capable and willing to successfully continue the business.
6. The succeeding of J. Crossan Hays, Yale graduate with Sheffield Scientific course training, to the position of President and General Manager, previously held by his father.
7. Advantage resulting from an established reputation.
8. Extensive product design creating diversified market which is almost unaffected by buying slumps in any one field of activity. In addition to numerous special items, over four hundred different standard products are produced.
9. Only general tool manufacturing concern producing an extensive line of vises, stone cutter's tools, and women's garden tools.
10. Furnishing of own power until 1912.
11. Maintaining superior quality of product.

Conditions Severely Testing Survival Ability and Their Solution:

1. About 1911 W. H. Hays invested heavily in another plant which, just prior to commencing operations, was completely destroyed by fire. No insurance protection was being maintained. Immediately afterward, about 15 per cent of the most highly skilled men left the company to open their own plant in Ohio. Their skill and a price reduction policy and familiarity with Iron City Tool customers enabled them to secure a sizeable portion of their previous employer's business. Conditions steadily deteriorated

for Iron City Tool until it was rescued by the enormous market created by World War I.

2. Most of Iron City Tool's exports were to Australia in the early 1920's. England, short of dollars, barred further import of tools from American concerns. This action disrupted the company's export sales and created a reduction of total sales which was gradually corrected by the expanding domestic market of the 1920's.
3. Again, in 1931, 1932 and the early part of 1933, the firm's business was greatly reduced. But the market created by the needs of the W.P.A. converted the depressed operations into the greatest activity, during 1934-1935, that the firm had ever experienced.

APPENDIX U-7

<i>Name of Firm:</i>	Jones & Laughlin Steel Corporation.
<i>Address:</i>	210 Ross Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Assistant to the President.
<i>Sequence of</i>	1853, Jones, Lauth & Co.
<i>Trade Styles:</i>	1861, Jones & Laughlins. 1883, Jones & Laughlins (Ltd.). 1902, Jones & Laughlin Steel Co. (Inc.). 1922, Jones & Laughlin Steel Corp.
<i>Products:</i>	Open-hearth and Bessemer steel, hot rolled products, sheets and strip, wire rope, alloy steel, tubular products, cold finished products, tin mill products, fabricated structural work, steel containers, and coal chemicals.
<i>Division of</i>	
<i>Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$25,000,000 and over.
<i>Distribution:</i>	Sales are to industrials, the railroad industry, utilities, automobile industry, and governmental agencies. Twenty-one district and several branch offices are maintained throughout the United States.
<i>Territory:</i>	Sales are made throughout the United States. Canadian, South American, and European sales are made through foreign subsidiaries.
<i>Seasons:</i>	Sales are comparatively steady throughout the year.
<i>Continuity of Control</i>	
<i>Established:</i>	1853.
<i>Conditions Surrounding Origin:</i>	
	B. F. Jones, a shipping clerk for the Mechanic Canal Transportation Line, became manager of the line before he was twenty-one. In 1846 he became a partner in the firm. He and his partner, S. M. Kier, purchased an iron furnace and forge in the Allegheny Mountains in 1847. By 1851 the firm was becoming increasingly interested in the production of iron. They decided to establish an iron furnace in

Pittsburgh and commenced negotiations with Bernard and John Lauth who were experienced iron manufacturers. A partnership was formed among the four men to operate The American Iron Works under the trade style of Jones, Lauth and Company. The first partnership agreement clearly shows that Messrs. Kier and Jones became partners in a venture already in operation by the Lauth Brothers on the South Side. The most creditable contemporary evidence is that the Lauths had not been in the iron business at that location prior to 1853. Under the partnership agreement no partner was permitted to withdraw funds, and all profits were reinvested into the business.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, power, transportation, and labor.
2. Products have experienced a rapidly expanding demand.

Longevity Factors Specifically Associated with Jones & Laughlin Steel Corporation:

1. Previous experience of the founders. The four original partners were successful businessmen who were familiar with the production of iron.
2. Timely origin of the company. Company was able to consolidate its position in the iron industry just prior to the Civil War.
3. Adequate financing during formative period. First S. M. Kier and then James Laughlin, president of Pittsburgh Trust Company, made available funds for necessary expansion.
4. Extensive expansion of facilities completed just in time to handle the unprecedented demand created by the Civil War.
5. Installation of a Bessemer steel plant completed in 1883. Coincidentally, or as a result of the birth of steel, railroads expanded and used thousands of tons of the new metal. (Carnegie completed a plant in 1875, but the demand for railroad steel was still undeveloped in 1883.)
6. Originator and sole producer of cold rolled polished shafting for many years.
7. Ownership and control of fuel supply.
8. Control of raw materials.
9. Partial control over water and rail transportation.
10. Product control from patents.

11. Frequent introduction of new products.
12. Intensive research and development.
13. Purchase of McDonald property and Woodlawn Park in 1905 for site of Aliquippa Plant.
14. Vast expansion program from 1909 to 1916 creating capacity required during the First World War.
15. Inauguration of river shipments of steel in 1921 avoided high cost of railroad and overland transportation.
16. Managerial guidance furnished by members of the Jones & Laughlin families and particularly B. F. Jones, Sr., and B. F. Jones, Jr.
17. Birth of children within the controlling families willing and capable of continuing the business.
18. Intentional training of children in the controlling families to fulfill executive positions.
19. Advantage of established reputation.
20. Employment of superior executive personnel to augment the guidance furnished by the members of the controlling families.
21. Financial policy resulting in heavy reinvestment of profits.

Solutions of Conditions Severely Testing Survival Ability:

The company has not experienced conditions which have severely tested its survival ability.

APPENDIX U-8

<i>Name of Firm:</i>	The Klein-Logan Company (Inc.).
<i>Address:</i>	116-36 South Thirteenth Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President, Secretary, and Treasurer.
<i>Sequence of Trade Styles:</i>	1856, John C. Klein. 1868, Klein, Logan & Co. 1891, The Klein-Logan Company (Inc.).
<i>Products:</i>	Forged tools such as heavy hammers, sledges, mattocks, wedges, picks, bars, grub hoes, mining and railroad track tools.
<i>Division of Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$100,000-\$250,000.
<i>Distribution:</i>	To contractors, railroads, and industry through jobbers and manufacturers' representatives.
<i>Territory:</i>	Entire United States during the period 1890-1947. Previously sales were virtually limited to Pittsburgh and immediate vicinity.
<i>Seasons:</i>	Fairly steady throughout the years.
<i>Continuity of Control Established:</i>	1856.

Conditions Surrounding Origin:

John C. Klein was born in Germany where his family engaged in a small metal working business. He arrived in Pittsburgh in 1847 and apprenticed himself to a locksmith. After completing his apprenticeship, he was employed by various local firms which profited considerably from his inventive mind. He accumulated a small amount of capital, and in 1856, with his brother, Fred C. Klein, opened a business to produce meat forks, miners' lamps, picks, shovels, pokers, and various tin items.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor.
2. Products have experienced a very steady demand. In general, product demand has expanded with negligible style changes.

Longevity Factors Specifically Associated with The Klein-Logan Co.:

1. Previous experience of the founder.
2. Timely entrance into new fields of production.
3. Inventive ability of John C. Klein and the advantages obtained from his numerous patents.
4. Managerial guidance furnished by Edward P. Logan, 1868-1925.
5. Securing government contracts for the production of bridle bits during the Civil War.
6. Greatly needed capital and administrative ability provided by Edward P. Logan's entrance into the business in 1868.
7. Very favorable financial relations. A member of the firm has served as an officer or member of the board of Iron and Glass Dollar Savings Bank, Pittsburgh, since 1879.
8. Conservative Scotch-Presbyterian influence on operating policy.
9. Birth of children within the controlling families willing and capable of successfully continuing the business.
10. Advantage resulting from an established reputation.
11. Maintaining superior quality of product.
12. Excellent labor relations.

Solutions of Conditions Severely Testing Survival Ability:

1. The depression of the early thirties was one of the severest crises the firm encountered. Although the company had not expanded or borrowed money in the boom twenties, it had been overly generous in its dividend payments. As a result its cash surplus was just enough to carry it through the lean years until the advent of the W.P.A. and its demand for hand tools made the business profitable again. Dr. J. Clarke Logan, a son of Edward P. Logan, became manager of the business in 1937, and he followed a conservative policy in order to build up the surplus until the company was again in a sound position.
2. A fire in 1884 completely destroyed the plant. Rebuilding and resumption of operations was made possible by a fortunate banking connection. Mr. Edward Logan was then serving as vice-president of the Iron and Glass Dollar Savings Bank.

APPENDIX U-9

<i>Name of Firm:</i>	Mackintosh-Hemphill Co. (Inc.).
<i>Address:</i>	901 Bingham Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Secretary and Treasurer.
<i>Sequence of</i>	1856, James Hemphill.
<i>Trade Styles:</i>	1859, Mackintosh, Hemphill, Hart & Co. 1866, Mackintosh, Hemphill & Co. 1893, Mackintosh-Hemphill & Co., Inc. 1920, Mackintosh-Hemphill Company (Inc.).
<i>Products:</i>	Rolling mill machinery, equipment, rolls and castings.
<i>Division of</i>	
<i>Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$1,000,000-\$5,000,000.
<i>Distribution:</i>	Large steel manufacturers.
<i>Territory:</i>	Entire United States. In addition, some export business is done with South America, India, Mexico, Africa, and Australia.
<i>Continuity of Control</i>	1856. The company accepts 1803 as its date of
<i>Established:</i>	origin. In 1865, A. Garrison & Co. succeeded to the ownership of the "Pittsburgh Foundry," the first foundry in Pittsburgh, established by Joseph McClurg in 1803. Mackintosh-Hemphill Company acquired control of A. Garrison Foundry Company in 1922. But, the Mackintosh-Hemphill Company, excluding its acquired holdings, was established by James Hemphill in 1856.

Conditions Surrounding Origin:

In the 1856 business directory for Pittsburgh and Allegheny, James Hemphill was first identified with the ownership of a manufacturing concern. He is reported to have participated widely in the production of iron before 1856, but little information is available regarding the establishment of the concern first bearing his name. In 1879, Mackintosh-Hemphill became, through purchase, the direct successor of the Fort Pitt Foundry established in 1803. In 1922, it

merged with concerns which were originally established in 1803 and in 1837, but continuity of control, excluding purchases in the company, could not be ascertained before 1856.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor.
2. Products have experienced a long term expanding demand.

Longevity Factors Specifically Associated with Mackintosh-Hemphill Co.:

1. Previous experience of founders.
2. Managerial guidance furnished by James Hemphill, Joseph Fawell, and J. Ramsey Spear.
3. Adequate financing during formative period.
4. Maintaining extensive research and development facilities from 1860-1947.
5. Inventive ability of James Hemphill and Joseph Fawell.
6. Advantages resulting from an established reputation.
7. Visionary engineering, design and building, enabling the company to introduce to the industry forty-one important "firsts" between 1860-1935. These include first universal mill, reversing blooming mill, garrett rod mill, large tin plate mill, aluminum continuous mill, hot strip mill, universal brass mill, and lamberton billet mill.
8. Control resulting from numerous patents covering such outstanding inventions as roll balancing and changing devices, "adamite" and other roll alloys, water cooled process for solidifying heavy bodies of rolls, corrugated cinder pots, and many others.
9. The steel industry's acceptance of James Hemphill's judgment as the standard of measurement for rolling mills and engine construction. (Mr. Frick called him "The Maker of Pittsburgh.")
10. The existence of a strong desire to perpetuate the business motivated both by pride and profit. (In 1880, James Hemphill refused a very attractive offer to become the partner of Andrew Carnegie. His refusal resulted largely from a desire to retain the separate identity of his firm.)

11. The acquisition of local competitors. (Few local enterprises have engaged in extensive manufacture of rolling mill machinery. The Mackintosh-Hemphill Company has reduced competition by acquiring control of several concerns, such as S. Jarvis Adams Company, Woodard Machine Company, Pittsburgh Iron and Steel Foundries Company, and A. Garrison Foundry Co.)

Solutions of Conditions Severely Testing Survival Ability:

At the time the present corporation was organized, it was primarily a manufacturer of heavy machinery for use by the larger steel producers. Subsequently, the demand of the steel industry turned to machinery for producing lighter and finished steel. The change in demand, combined with the depression years of the early 1930's, produced a succession of unfavorable years and the company's financial condition became unbalanced. A Bondholders Protective Committee was formed, and on October 10, 1935 the company filed a voluntary petition in bankruptcy under Section 77B of the National Bankruptcy Act. This action resulted in favorable refinancing which, along with the sale of the Wooster, Ohio plant for \$550,000 cash and the return to a profitable operating basis in 1936, provided for the 77B proceedings to be terminated on October 10, 1936 without creditors sustaining any loss. Favorable operating conditions largely resulted from converting production from heavy to light machinery.

APPENDIX U-10

<i>Name of Firm:</i>	Marshall Elevator Company (Inc.).
<i>Address:</i>	2015 Mary Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Vice President and Treasurer.
<i>Sequence of</i>	1818, John Marshall (Proprietorship).
<i>Trade Styles:</i>	1845, Marshall Brothers (Partnership). 1903, Marshall Brothers Co. (Inc.). 1932, Marshall Elevator Company (Proprietorship). 1945, Marshall Elevator Co. (Inc.).
<i>Products:</i>	All types of passenger and freight elevators; manufactured, installed, and repaired.
<i>Division of</i>	
<i>Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$100,000–\$250,000 (estimate only).
<i>Distribution:</i>	Sales are to industrial plants, commercial buildings, hospitals, stores, and apartments.
<i>Territory:</i>	Most sales are to customers located within 150 miles of Pittsburgh, although sales are made throughout the United States, Europe, Africa, China, and South America.
<i>Seasons:</i>	Steady throughout the year.
<i>Continuity of Control</i>	
<i>Established:</i>	1818.

Conditions Surrounding Origin:

John Marshall operated his own metal and blacksmithing shop in England. At that time artisans were not permitted to leave England, but he succeeded somehow in securing passage to Canada for himself and family; thence to Pittsburgh in 1818, and being skilled in the metal trade established his business.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor.
2. Product has experienced an expanding demand.

Longevity Factors Specifically Associated with Marshall Elevator Company:

1. Original concern of its kind in Allegheny County.
2. Previous experience of the founder.
3. Allegheny county's pioneer manufacturer of spiral stairway fire escapes, and hand powered, hydraulic, steam, and electric elevators.
4. Managerial guidance furnished by John Marshall 1818-1845; his sons John, Michael, and Joseph Marshall 1845-1892; Robert, George Vardy, George Thomson, Lee Holmes Marshall 1892-1932; George Thomson Marshall 1932-1948; Ralph B. Marshall 1948.
5. Birth of children, within the controlling family, capable and willing to successfully continue the business.
6. The intentional training of the controlling family's children to assume executive positions with the company.
7. Advantage resulting from an established reputation.
8. Mechanical and inventive ability of members of the family aided in the growth of the business.
9. Conservative operating policy limiting expansion to a size easily managed by the personal supervision of members of the controlling family.
10. Prudent financial policy enabling the company to operate without resorting to outside financing.
11. Excellent labor relations. (Over 50 per cent of the present employees have over twenty-five years of service with the company.)
12. The practice of manufacturing and installing elevators which provided repair business during business recessions when original sales are negligible.
13. Emphasis on the manufacture of products of superior quality.

Conditions Severely Testing Survival Ability and Their Solution:

Survival ability has never been severely tested. The Civil War reconstruction period and the depression of the 1930's provided the two most difficult times in the company's history. The difficulties of the Civil War reconstruction period were largely offset by the sales demand resulting from the introduction of a patented spiral stairway fire escape. The reduced sales volume of original equipment encountered in the depression of the 1930's was compensated for by a substantial increase in repair and servicing business.

APPENDIX U-11

<i>Name of Firm:</i>	R. Munroe & Sons Manufacturing Corp.
<i>Address:</i>	23rd & Smallman Sts., Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Vice-President.
<i>Sequence of</i>	1856, Watson & Munroe.
<i>Trade Styles:</i>	1865, Robert Munroe. 1884, Robert Munroe & Son. 1903, R. Munroe & Sons Mfg. Corp.
<i>Products:</i>	Tanks, boilers, stacks, and other plate steel construction and the erection of its own products.
<i>Division of</i>	Iron and steel, copper and aluminum, and their
<i>Manufacturing:</i>	products.
<i>Net Worth Class:</i>	\$250,000-\$500,000.
<i>Distribution:</i>	To industrial concerns, mines, hospitals, chemical and oil industries, hotels, state and municipal divisions and public utilities, schools and public buildings.
<i>Territory:</i>	Throughout Pennsylvania and neighboring states. Territory limited to Pittsburgh and immediate vicinity until about 1890.
<i>Seasons:</i>	Comparatively steady throughout the year.
<i>Continuity of Control</i>	
<i>Established:</i>	1856.

Conditions Surrounding Origin:

In 1835 the Whiteman Boiler and Tank Co. established the first boiler works in Pittsburgh. They operated this plant under the style of West Point Boiler Works until 1856 when they sold out to A. Watson and R. Munroe, Sr., with funds provided by R. Munroe, Sr., a former photographer, who had confidence in the future of the sheet iron industry. A. Watson, his partner in the concern, possessed considerable experience in boiler manufacturing. The new partners changed the trade style to Watson & Munroe.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to raw materials, sales market, power, transportation, and labor.
2. Products have experienced an expanding demand.

Longevity Factors Specifically Associated with R. Munroe & Sons Manufacturing Corp.:

1. Acquisition of the original manufacturing plant of its type in Allegheny County at a time when only a few competitors had entered the field.
2. Previous experience of the founders.
3. Adequate working capital during infancy of the business.
4. Timeliness of entrance into the industry. (The company was ready when a tremendous demand for its products was created by the Civil War.)
5. Managerial guidance furnished by R. Munroe, Sr. 1856-1903; Robert Munroe, Jr. 1890-1943; E. R. Munroe at present.
6. Birth of children within the controlling family willing and capable of successfully continuing the business.
7. The intentional training of children in the controlling family to prepare them to operate the business successfully.
8. Advantages obtained from several patents, particularly from 1886 to 1903, when the company's patent flanged manhole and cover for boilers was the only patent of its kind in existence.
9. Advantage of established reputation.
10. Company's major efforts concentrated on the building and installation of stacks from about 1900-1930. Stack building requires the presence of an experienced supervisor during the entire installation. The firm, with the supervising service of Robert, Jr., and Charles L. Munroe, was able to contract for several large jobs simultaneously. Consequently, their reputation for building and installing stacks secured for them almost all the major stack installations throughout the steel industry, such as Gary Steel Works, Inland Steel Company, Sharon Steel Company, Donora Steel Works, Forged Steel Wheel Company, Carnegie Steel Company, National Tube Company, American Sheet & Tin Plate Company, and Weirton Steel Company.
11. Favorable labor relations.
12. Conservative Scotch-Presbyterian influence on operating policy.
13. Ability to produce any type of item requiring sheet iron or steel formation.
14. Maintaining superior quality in product.

Conditions Severely Testing Survival Ability and Their Solutions:

Company has never encountered conditions which severely tested survival ability.

APPENDIX U-12

<i>Name of Firm:</i>	Oliver Iron and Steel Corporation.
<i>Address:</i>	South 10th and Muriel Streets, Pittsburgh 3, Pennsylvania.
<i>Officials Interviewed:</i>	Treasurer and Secretary.
<i>Sequence of Trade Styles:</i>	1861, Lewis and Phillips. 1863, Lewis, Oliver and Phillips. 1880, Oliver Bros. and Phillips. 1887, Oliver Iron and Steel Company. 1922, Oliver Iron and Steel Corporation.
<i>Products:</i>	Bolts, nuts, rivets, small forgings, pole line hardware, hydraulic motors, hydraulic pumps, hydraulic valves.
<i>Division of Manufacturing:</i>	Products made from iron and steel, copper-base alloys, and aluminum.
<i>Distribution:</i>	Sales are to utilities, railroads, and industrials, direct and through distributors.
<i>Net Worth Class:</i>	\$5,000,000—\$10,000,000.
<i>Territory:</i>	Selling territory is national and sales branches are maintained at strategic points throughout the United States. Export sales are made of industrial fasteners to Canada, Central and South American countries, Puerto Rico, Philippine Islands, India, and South Africa. Pole line hardware sales are made to South American countries, India, and South Africa.
<i>Seasons:</i>	Volume is relatively well sustained throughout the year.
<i>Continuity of Control Established:</i>	1861.
<i>Conditions Surrounding Origin:</i>	

About 1860, William J. Lewis patented the first bolt-making machine. Mr. John Phillips, a business man with some capital, appreciated the great value of the invention and joined with Mr. Lewis in

organizing a bolt works in 1861. When Henry W. Oliver became a partner in 1863, the trade style changed to Lewis, Oliver and Phillips. In the early part of the following year, they associated with them James B. Oliver and in the latter part of the same year, David B. Oliver. David B. Oliver had previously been a partner in the Kittanning Iron Works. The great demand for the company's products, largely created by the Civil War, was an outstanding factor contributing to their early rapid expansion.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, power, transportation, and labor.
2. Products have experienced a long-range, expanding demand without material style change.

Longevity Factors Specifically Associated with Oliver Iron and Steel Corporation:

1. Previous experience of the founders.
2. Timely origin of the business. (The firm originated just prior to the outbreak of the Civil War which created a great demand for the company's products.)
3. Availability of adequate financing during formative years of the business.
4. Managerial guidance furnished by the controlling interests, particularly the Oliver family.
5. Birth of children within the controlling families willing and capable of successfully continuing the business.
6. The employment of exceedingly capable administrators to augment the guidance furnished by the controlling interest.
7. The inventive ability of William J. Lewis and the advantages obtained from his patents.
8. Control of raw materials. (While it appeared profitable, the company owned and operated its own ore deposits, rolling mills, and steel plants.)
9. Control of fuel. (While it appeared economical, the company owned and operated its own coal mines and also supplied its own gas from 16 wells owned in Washington and Greene counties which were connected to the plant by a company owned gas line.)

10. Control of transportation. (The company operated its own boats and barges for a number of years. A wholly owned subsidiary, The Allegheny and Southside Railway Company, was chartered in 1892 to connect and operate on the trunk lines of the Pennsylvania and Pittsburgh and Lake Erie Railroads.)
11. The rapid adoption of new machinery and new methods of production.
12. Emphasis placed on superior quality of product.
13. First concern to recognize the advantage of using soft steel in the production of bolts.
14. Advantage resulting from an established reputation.
15. The immediate addition of profitable, and abandonment of unprofitable, lines of production.

Solutions of Conditions Severely Testing Survival Ability:

The company has not encountered conditions which severely tested its survival ability. However, a retrogressive operating trend set in during the early depression years of the 1930's and losses were sustained. Those losses materially affected the liquidity position of the business and sizable bank financing was obtained to provide necessary working capital. Those loans were subsequently paid off and liquidated. The adverse operating trend was reversed following a rather sharp rise in volume which resulted from a demand for industrial fasteners and pole line materials created by WPA and the general improvement in business conditions throughout the country. In 1941 the company began producing in connection with the national defense program and volume increased substantially during the war years.

APPENDIX U-13

<i>Name of Firm:</i>	Rieger Iron & Wire Works, Inc.
<i>Address:</i>	824-26 Second Avenue, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President, Vice President.
<i>Sequence of</i>	1868, Christ Rieger.
<i>Trade Styles:</i>	1908, Rieger Iron & Wire Works. 1924, Rieger Iron & Wire Works, Inc.
<i>Products:</i>	Railing, iron stairs, fire escapes, wire fences, and other specialties.
<i>Division of</i>	
<i>Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$10,000-\$25,000.
<i>Distribution:</i>	Sales are to local contractors, industrial and commercial enterprises, and home owners.
<i>Territory:</i>	Pittsburgh area.
<i>Seasons:</i>	Closely follows construction activity.
<i>Continuity of Control</i>	
<i>Established:</i>	1868.

Conditions Surrounding Origin:

Christ Rieger, German born, learned the metal working trade before coming to the United States in 1865. After arriving in Pittsburgh, he was employed by various metal working firms until 1868, when he acquired an iron and wire concern which had been established and operated by Mr. Francis Cluley since 1859.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to raw materials, sales market, power, transportation, and labor.
2. Product experienced an expanding demand for more than forty years after the business originated.

Longevity Factors Specifically Associated with the Rieger Iron & Wire Works, Inc.:

1. Previous experience of the founder.
2. Managerial guidance furnished by Christ Rieger, Harry Rieger, and Louis A. Wieland.

3. Birth of children within the controlling family, willing and capable of continuing the business.
4. The intentional training of Harry Rieger, by his father, to assume the control of the business.
5. Mr. Louis A. Wieland had over forty years experience with Taylor and Dean; his sons Lawrence A. Wieland twenty years; Harry L. Wieland fifteen years; and Louis C. Wieland five years. None of the Wielands had worked at Rieger Iron & Wire Works prior to the death of Harry Rieger in 1921. However, the Wielands purchased the business shortly thereafter.
6. Advantage resulting from an established reputation.
7. The size of the firm to avoid the diseconomies of large-scale operations.
8. The nature of the product requiring a skill of craftsmanship which is becoming increasingly difficult to find. The president of the firm, although eighty-one years of age, is still active, and has passed his knowledge on to his four sons, four grandsons, and other descendants who are employed in the business.
9. Emphasis placed on producing a product of superior quality.
10. Constant attempt to maintain a superior quality of service.
11. The ownership, management, and almost complete operation of the business by members of the same family since 1921. This condition has eliminated labor disputes, inefficiency, and turnover, and has provided a closely knit organization capable of a degree of retrenchment or expansion which is unobtainable by the average manufacturing concern.

Solutions of Conditions Severely Testing Survival Ability:

The depression of the 1930's placed this company in a serious financial condition. If it had been a typical manufacturing concern, it probably would not have been able to survive the depression. But, this family-owned business made every possible sacrifice to survive. Since other forms of employment were limited, the continuation of the business seemed to offer the best source of employment to the members of the family. They cut their own salaries to a bare subsistence level and finally ceased to take any money. Instead they placed their own savings in the business, mortgaged and eventually lost their homes. However, they succeeded in keeping the business alive. The general improvement in business conditions enabled the concern to return to a favorable operating position.

APPENDIX U-14

<i>Name of Firm:</i>	Scaife Company (Inc.).
<i>Address:</i>	Oakmont, Pennsylvania.
<i>Officials Interviewed:</i>	Assistant to the President, Secretary, and Treasurer.
<i>Sequence of</i>	1802, Jeffery Scaife.
<i>Trade Styles:</i>	1834, William B. Scaife & Co. 1838, William B. Scaife. 1849, Scaife & Atkinson. 1851, Scaife, Atkinson & Okely. 1853, William B. Scaife. 1871, William B. Scaife & Sons. 1901, William B. Scaife & Sons. Co., (Inc.). 1941, Scaife Company (Inc.).
<i>Products:</i>	A line of high pressure tanks of air, gas, and liquids, also range boilers, cylinders, and general storage containers. Prior to 1870 production shifted from one product to another. These items included copper, tin, sheet iron, and japanned products such as sponge buckets for the War of 1812, iron and other metal items for river boats, oil tanks, iron roofs, iron bridges, and kitchen utensils.
<i>Division of</i>	
<i>Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$1,000,000-\$5,000,000.
<i>Distribution:</i>	Principally to industrials and jobbers and plumbing suppliers.
<i>Territory:</i>	The entire United States. Principally Pittsburgh and immediate vicinity prior to 1870.
<i>Seasons:</i>	Subject to seasonal variation. Sales closely parallel construction activity.
<i>Continuity of Control</i>	
<i>Established:</i>	1802.
<i>Conditions Surrounding Origin:</i>	

Jeffery Scaife came from Cambridge, England to Philadelphia, Pennsylvania in 1789 and there learned the trade of tinning and the

manufacture of japanned goods under Thomas Passmore, later becoming his foreman. He then came to Pittsburgh in 1801 and the next year associated with his uncle, William Gazzam, and William Borett, his future father-in-law, he established his own shop to produce tin, copper, sheet iron, and japanned wares.

Factors Contributing to the Longevity of any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor.
2. Product demand has constantly expanded since 1870. Several items produced between 1802–1870 encountered an undeveloped demand.

Longevity Factors Specifically Associated with Scaife Company:

1. Early entrance into the manufacture of metal products in Allegheny County.
2. Previous experience of the founder.
3. Managerial guidance furnished by five generations of the Scaife family and particularly Jeffery Scaife, 1802–1833; William B. Scaife, 1834–1875; and Charles C. Scaife, 1876–1915.
4. Birth of children within the controlling family, willing and capable of successfully continuing the business.
5. Flexible operating policy which permitted line after line of products to be adopted and subsequently abandoned before changing conditions made them unprofitable.
6. Allegheny County's pioneer manufacturer of architectural iron, iron roofs, corrugated iron sheeting, wrought-iron kitchen range boilers, and various types of pressure vessels.
7. William B. Scaife's inventive ability and the advantages obtained from his numerous patents which included kitchen range boilers, dome head range boilers, elevator buckets, and plate iron and storage tanks.
8. Advantage obtained from an established reputation.
9. The intentional training of children of the controlling family to assume managerial positions.
10. Constant emphasis on producing a product of superior quality.
11. Favorable financial connections.
12. Conservative operating policy restricting expansion to a controllable size.

Conditions Severely Testing Survival Ability and Their Solutions:

The company has never had its survival ability severely tested. There were, however, four difficult periods in the company's history.

1. During Pittsburgh's disastrous fire in 1845 the company's plant, unprotected by insurance, was almost totally destroyed. The profits derived from the then rapidly expanding boat building industry contributed greatly to the restoration of the fire losses.
2. Assignment by W. B. Scaife to creditors in November, 1853 due to defalcation of one of the partners; also loss caused by a fire which destroyed considerable property.
3. Following the Civil War the company's sales suffered a serious reduction. The decreased sales volume was more than regained by W. B. Scaife's invention of the wrought-iron kitchen range boiler. Orders for range boilers began to pour into the company, some arriving from Germany and other European countries.
4. The depression of the 1930's ushered in the company's third difficult period of operations. This condition generally continued until it was corrected by government contracts received in the Second World War period.

APPENDIX U-15

<i>Name of Firm:</i>	Westinghouse Air Brake Company (Inc.).
<i>Address:</i>	Wilmerding, Pennsylvania.
<i>Officials Interviewed:</i>	Vice-President and Secretary.
<i>Sequence of Trade Styles:</i>	1869, The Westinghouse Air Brake Company (Inc.).
<i>Products:</i>	Railroad equipment including air brakes, accessories for railway vehicles, centralized traffic control, and continuous cab signaling systems—a complete line of block signaling and automotive slack adjusters.
<i>Division of Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$25,000,000 and over.
<i>Distribution:</i>	Principally to the railroad industry; also, industrials including the automotive industry.
<i>Territory:</i>	Sales are made throughout the United States, Canada, and South America, with European sales made through several foreign subsidiaries.
<i>Seasons:</i>	Sales comparatively steady throughout the entire year.
<i>Continuity of Control Established:</i>	1869.

Conditions Surrounding Origin:

On a trip between Troy and Schenectady a wreck delayed George Westinghouse, the future inventor. Although the engineers saw each other in broad daylight and tried to stop on a straight stretch of track, there was not enough time. Emergency stopping was impossible then because each car of a train had to be braked separately by a brakeman who set the hand brakes with a pick handle. From that day on George Westinghouse worked to design a brake which would provide emergency stopping.

After working on his design two years, he was issued a patent in April 13, 1869. The building of demonstration equipment was financed by the support of a Pittsburgh foundry executive. A test run was arranged on the Pennsylvania Railroad and, by accident, a

huckster's cart stalled directly in the path of the approaching train provided for the demonstration of the first successful emergency stop in railroad history. It brought fame to the brake's inventor, and a corporation was formed to manufacture the air brake under the trade style of The Westinghouse Air Brake Company.

Factors Contributing to the Longevity of any Concern Operating under Similar Conditions:

1. Location provided proximity to raw materials, sales market, power, transportation, and labor.
2. Products have experienced an expanding demand. Originally there existed a vast potential demand which was undeveloped.

Longevity Factors Specifically Associated with Westinghouse Air Brake Company:

1. Timely origin of the company. (There were only 40,000 miles of track in 1869, but from 1870 to 1880 that trackage doubled, and it doubled again during the following decade.)
2. Managerial guidance furnished by George Westinghouse 1869-1914.
3. The filling of executive positions by employees possessing a thorough knowledge of the operation of the business. Of the successors to the first president, three had been identified with the company for more than forty years before being elected.
4. George Westinghouse's close association with such men as Mr. Robert Pitcairn, Vice President of the Pennsylvania Railroad.
5. The inventive ability of George Westinghouse and the advantages obtained from his numerous patents. (He averaged a new patent each six weeks over a period of forty-eight years.)
6. The possession of an almost monopolistic position in the air brake field since the company's beginning.
7. Constant research and development enabling the introduction of improvements repeatedly creating new markets by discarding obsolete for revolutionized air brake equipment. Such improvements include the Triple Valve Automatic Brakes, Quick-Action Brakes, A-B Brakes, Speed Governor control of the braking force on high speed passenger trains, and the Decelostat control to prevent wheels sliding.
8. The passing by Congress, in 1893, of the "Federal Safety Appliance Act" requiring the use of power brakes on railroad rolling stock.

9. Voting by the railroads of America in 1933 to obsolete the "K" type brake, standardized in 1911, and substitute the "AB" type brake as standard equipment on all freight cars in this country. The "K" brake was designed to operate in 80 car trains and the "AB" brake was designed to operate in 150 car trains.
10. Excellent employee relations resulting from progressive labor policy. (First American company to adopt the Saturday afternoon half-holiday. Created a pension plan in 1908. Early adopted two-week vacations with pay, a program providing disability benefits, medical services, and group life insurance.)
11. The pioneering and introduction of numerous signaling devices leading to the formation of Union Switch and Signal Company.
12. Advantage resulting from an established reputation.

Solutions of Conditions Severely Testing Survival Ability:

The company has not experienced such conditions.

APPENDIX U-16

<i>Name of Firm:</i>	A. W. Cadman Manufacturing Co.
<i>Address:</i>	2816 Smallman Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President.
<i>Sequence of</i>	1860, Fulton & Co.
<i>Trade Styles:</i>	1863, Cadman & Crawford. 1869, S. Cadman & Son. 1877, A. W. Cadman & Company. 1891, A. W. Cadman Manufacturing Co.
<i>Products:</i>	Brass, bronze, and aluminum castings — pure copper, high conductivity castings — hardened copper, high conductivity castings, and Babbitt metals.
<i>Division of</i>	
<i>Manufacturing:</i>	Metals, nonferrous and their products.
<i>Net Worth Class:*</i>	\$50,000—\$100,000.
<i>Distribution:</i>	Principally river craft during infancy of concern. Today sales are principally to steel companies and to heavy industry.
<i>Territory:</i>	The entire United States, and some export.
<i>Seasons:</i>	Fairly steady.
<i>Continuity of Control</i>	1860. (S. Cadman, grandfather of the present
<i>Established:</i>	president, was one of the founders of Fulton & Co.)

Conditions Surrounding Origin:

In 1858 there were built at Pittsburgh eighty-four steamships at a value of \$1,680,000. During the previous five years, Allegheny County had averaged seventy-two new steamers a year. S. Cadman, a river pilot, observed in his work many needed improvements in steamer bells, whistles, and pipe fittings. Although Allegheny County already possessed eight well established brass and bell

* Replacement cost or sound value of working assets substantially exceeds their carrying value in net worth calculation.

foundries, S. Cadman thought his familiarity with the river trade requirements would enable him to compete successfully with the existing firms. His ideas persuaded Fulton, a long established foundry operator, to combine with him in opening a brass and bell foundry under the name of Fulton & Co., in 1860.

Factors Contributing to the Longevity of any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, (river trade between 1860 and 1890, local industry from 1890 on) adequate power facilities and necessary labor market.
2. River craft equipment demand expanded and then diminished. Present products have experienced constant demand without widespread style variations.

Longevity Factors Specifically Associated with A. W. Cadman Manufacturing Co.:

1. Previous foundry experience of Fulton.
2. S. Cadman's familiarity with prospective consumers' needs.
3. Subsequent direction of the concern by A. W. Cadman, son of S. Cadman, whose knowledge acquired as a river pilot enabled the firm to continue possessing superior knowledge of prospective consumers' needs.
4. Adequate operating capital available during the concern's infancy.
5. S. Cadman's and A. W. Cadman's close association with the river trade, which for many years absorbed the major portion of the firm's production.
6. Birth of children within the family willing and capable of successfully continuing the firm. Currently, the business is managed by A. M. Cadman, grandson of S. Cadman. A. M. Cadman, Jr., great grandson of S. Cadman, is a director of the company and is actively engaged in the business. Ability to train competent, loyal employees.
7. Long use of standardized production procedures decreasing material and labor costs.
8. Converting production from river craft to the steel and heavy industry.

9. Ability to produce copper castings of considerable unit weight (3500 lb.) without alloying: copper content $99.4 \pm$ retaining high thermal and electrical conductivity 80 to 95 per cent—used principally in the construction and maintenance of electric alloy steel melting furnaces. This business is not highly competitive. Few nonferrous foundries attempt founding of pure copper castings.
10. In 1890 procuring patent for alloy casting which has experienced a constantly increasing demand.
11. In 1922 developing a lead babbitt process which competitors have not been able to duplicate.
12. Constantly producing a quality product, particularly special items not readily manufactured.
13. Purposely remaining small to avoid diseconomies of large size and enable business to operate under personal supervision.
14. A conservative attitude, first demonstrated by S. Cadman, constantly permeating the operating policy.
15. Advantage resulting from an established reputation.

Conditions Severely Testing Survival Ability and Their Solutions:

None revealed by interview or discovered elsewhere. Business has consistently operated without outside financing.

APPENDIX U-17

<i>Name of Firm:</i>	The Chaplin-Fulton Manufacturing Co. (Inc.).
<i>Address:</i>	5800 Grand Avenue, Pittsburgh 25, Neville Island, Pennsylvania.
<i>Officials Interviewed:</i>	Vice-President.
<i>Sequence of Trade Styles:</i>	1832, Fulton, Andrew 1866, Fulton, Andrew & Sons. 1871, Fulton, A. Son & Co. 1884, Chaplin-Fulton, Ltd. 1891, Chaplin-Fulton Manufacturing Co. (Inc.)
<i>Products:</i>	Gas governors, regulators, and steam specialties such as valves for gas, steam, water, and air; gauge cocks. Originally a brass foundry, then manufactured equipment for river boats and gradually converted to present products.
<i>Division of Manufacturing:</i>	Metals, nonferrous and their products.
<i>Net Worth Class:</i>	\$1,000,000-\$5,000,000.
<i>Distribution:</i>	Local industry, 1832-1840; principally local industry and river craft, 1840-1880; local steel and gas industries, 1880-1912. Nationwide industry and public utilities, 1912 to the present. Also some foreign sales.
<i>Territory:</i>	Throughout the United States.
<i>Seasons:</i>	Very steady throughout the year.
<i>Continuity of Control Established:</i>	1832. Present president, Alex. M. Brooks, grandson of M. B. Chaplin. Present Vice-President, R. H. Kaufman, grandson of Louis Fulton, president from 1891-1916 and nephew of original founder, A. Fulton.
<i>Conditions Surrounding Origin:</i>	Only determinable fact was that no other brass foundry existed in Allegheny County in 1832.

Factors Contributing to the Longevity of any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, adequate transportation facilities, power, and labor. Location of extreme importance prior to about 1925, but not particularly advantageous during past 20 years.
2. Demand for general foundry products expanded and then gradually decreased. Demand for river-craft production expanded and then gradually decreased. Demand for present products has constantly expanded. Demand has never been subject to widespread style variation.

Longevity Factors Specifically Associated with Chaplin-Fulton Manufacturing Co. (Inc.):

1. Original Allegheny County manufacturer in its field.
2. Only Allegheny County manufacturer in its field from 1832 to 1836.
3. Timeliness of entrance into gas industry business.
4. Flexibility in transferring production from general foundry products to steamer equipment and subsequently to the needs of the steel and gas industries.
5. Knowledge of river craft requirements resulting from Lewis Fulton's experience as a river engineer.
6. Managerial guidance furnished by Andrew Fulton, 1832-1880; Lewis Fulton, 1884-1916; William McKee, 1916-1934.
7. Birth of children, within the family, willing and capable of successfully continuing the business.
8. Advantage resulting from an established reputation, especially noticeable when gas workers in the Pittsburgh area moved to Oklahoma-Texas field.
9. Financing furnished by W. M. Ralston during the 1880's.
10. Inventive ability of Lewis Fulton and the advantages from his numerous patents. (Over sixty patents between 1860-1910.)
11. Rigid training procedure followed by family members entering the firm after 1884. (Average of six years spent learning various phases of the business before family members could secure executive positions.)
12. Superiority over competitive products.
13. Control over raw materials. (Operated own brass foundry until 1945.)

14. Conservative operating policy. (Company has repeatedly disregarded opportunities to expand by concentrating on maximum volume from existing plant capacity.)
15. Until 1920, the company was almost alone in the manufacture of regulators, gauge cocks, and similar equipment for the gas industry.
16. Strong financial position. (Dividends paid regularly since 1891.)

Conditions Severely Testing Survival Ability and Their Solutions:

1. Until the demands of the gas industry replaced the decreased requirements of river craft, the company survived through the financing of W. M. Ralston, a partner of Chaplin-Fulton, Ltd.
2. The critical period of 1931-1933 was relieved by the steel industry's modernization program which, in 1934, commenced the conversion of furnaces to gas fuel.

APPENDIX U-18

<i>Name of Firm:</i>	Collins & Wright, Inc.
<i>Address:</i>	5501-09 Butler Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President and Treasurer.
<i>Sequence of Trade Styles:</i>	1838, Pittsburgh Britannia Manufacturing Co. 1868, Collins & Wright. 1923, Collins & Wright, Inc.
<i>Products:</i>	Salt and pepper shaker tops from Britannia metal.
<i>Division of Manufacturing:</i>	Metals, nonferrous, and their products.
<i>Net Worth Class:</i>	\$25,000-\$50,000.
<i>Distribution:</i>	Glass manufacturers, 1838-1932; glass manufacturers, dealers, hotels and restaurants, 1932-1947.
<i>Territory:</i>	United States and Canada.
<i>Seasons:</i>	Comparatively steady throughout the year.
<i>Continuity of Control Established:</i>	1838 (Firm developed from enterprise established by Orvin Newton in 1831.)

Conditions Surrounding Origin:

By 1838 Allegheny County had several glass factories which required very high grade cast iron for making their molds. Orvin Newton, who established an iron foundry in 1831, specialized in making castings for the glass works and was thereby placed in close contact with the problems of the glass manufacturers. The glass concerns discovered that to manufacture glass tops for their shakers was not only expensive but impractical, for glass either expands or contracts with temperature variation and the tops do not screw on the bottoms properly. Newton conceived the idea of using cast metal, and his experiments with Britannia metal proved successful. He separated his new business from his general foundry, and with Mr. Henry Collins, an influential business man in the glass industry, organized the Pittsburgh Britannia Manufacturing Company.

Factors Contributing to the Longevity of any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, transportation facilities, power, and labor.
2. Product demand was undeveloped in 1838, constantly expanded from 1838 to 1930, and has been subject to a minimum of change in style.

Longevity Factors Specifically Associated with Collins & Wright, Inc.:

1. Original producer in its field.
2. Adequate funds, supplied by Henry Collins, for working capital and expansion during the early years of the business.
3. Previous business and manufacturing experience of the founders.
4. Mr. Collins' close association with the glass industry which for many years absorbed the entire output of the firm's product.
5. Inventive ability of Homer Wright and the advantages obtained from his numerous patents.
6. Control of adequate fuel supply prior to the introduction of gas.
7. Price, territory, and product agreement with Lang & Lauster and Manning-Bowman & Company in 1880.
8. Managerial guidance furnished by Homer Wright from 1847 to 1919.
9. Birth of children within the family willing and capable of successfully continuing the firm.
10. Advantage resulting from an established reputation.
11. Adoption of new methods of distribution in the early 1930's.
12. Financing provided by the Wright family during the 1930's.
13. Employment of capable administrators to augment the guidance furnished by the controlling interest.

Conditions Severely Testing Survival Ability and Their Solutions:

From 1838 until the early 1930's, the entire finished product was disposed of to large glass manufacturers. But, the change over to lower priced sheet metal tops was rapidly excluding Britannia top producers from the market by 1932. The business survived by diverting distribution directly to restaurants, hotels, and other establishments which continued to use quality trimmings for table glassware, and by introducing their tops for the more expensive types of metal bottoms. Also, operating losses during this period were defrayed by funds provided by the Wright family.

APPENDIX U-19

<i>Name of Firm:</i>	Kincaid Brothers.
<i>Address:</i>	211 Water Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Present proprietor.
<i>Sequence of</i>	1839, James T. Kincaid.†
<i>Trade Styles:</i>	1872, James T. Kincaid & Son. 1880, James T. Kincaid, Jr. 1890, Charles W. Kincaid. 1892, Kincaid Brothers.
<i>Products:</i>	Sheet metal fabrication, Kincaid Cook Stoves, Eureka Syphon.
<i>Division of</i>	
<i>Manufacturing:</i>	Metals, nonferrous and their products.
<i>Seasons:</i>	Comparatively steady throughout the year.
<i>Net Worth Class:*</i>	\$10,000—\$25,000.
<i>Distribution:</i>	Sales are to mill and mine supply companies, river transportation, restaurants, elevator companies, and to industrial concerns.
<i>Territory:</i>	Majority of accounts located in Allegheny County; but accounts are scattered all over the United States.
<i>Continuity of Control</i>	
<i>Established:</i>	1839 (or 1831?) .†

Conditions Surrounding Origin:

In 1816, James T. Kincaid, at the age of sixteen, was indentured until he was twenty-one to Humbert & Company to learn "the arts and mysteries of tin plate working." After serving the indenture period he was employed by various tin plate working firms. Together with a partner he went into business in 1831 and in 1839 took it over himself. The first actual record of the firm's existence is the 1839 City Directory.

* Replacement cost or sound value of working assets substantially exceeds their carrying value in net worth calculation.

† Author could not find records of earlier existence, although present proprietor is sure company originated in 1831 with trade style of Kincaid & ?—other name not remembered.

Factors Contributing to the Longevity of any Concern Operating under Similar Conditions:

Location provided proximity to sales market, raw materials, power, and labor.

Longevity Factors Specifically Associated with Kincaid Brothers:

1. Previous experience of the founder.
2. Birth of children within the family willing and capable of successfully continuing the business.
3. Advantage resulting from an established reputation.
4. Managerial ability of James T. Kincaid, 1839–1880; Charles W. Kincaid, 1890–1939, Thomas C. Kincaid, 1939.
5. Patent control established on Kincaid Cook Stove, first stove to have the heat all the way round the oven in Pittsburgh, and manufactured first for the “Portage Railroad in 1835.” Also patent control on Eureka Syphons, 1900.
6. Charles W. Kincaid’s business experience gained as auditor for Westinghouse Air Brake Company.
7. Superiority over competitor’s products.
8. Limiting size of firm to enable personal supervision of operations.

Solutions of Conditions Severely Testing Survival Ability:

After James T. Kincaid died in 1880, the firm was poorly managed by James T. Kincaid, Jr., who well understood production problems but was incapable of coping with business affairs. Certain bankruptcy was avoided with the measures instituted by Charles W. Kincaid, who resigned an excellent position to enter the business in 1890.

APPENDIX U-20

<i>Name of Firm:</i>	Tranter Manufacturing Company.
<i>Address:</i>	105 Water Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President, Vice-President.
<i>Sequence of</i>	1836, J. B. Sheriff.
<i>Trade Styles:</i>	1865, Sheriff & McGraw.
	1867, Sheriff, Loughrey & McGraw.
	1869, Sheriff & Loughrey.
	1875, J. B. Sheriff & Son.
	1882, J. B. Sheriff, Son & Co.
	1892, J. B. Sheriff Manufacturing Co.
	1898, Tranter-Davidson Manufacturing Co.
	1903, Tranter Manufacturing Company.
<i>Products:</i>	Woodworking machinery, ironworking machinery, pumps, air compressors, transmission equipment such as V belt drives, gear reducers; also general shop equipment such as steel work benches, presses, vises, etc. The company also designs and manufactures special machines and shop equipment and does a general repair machine business. Originally a brass foundry and coppersmiths for the river trade, the company later added the manufacture of several different types of ejectors and jet pumps, which are still made.
<i>Division of</i>	
<i>Manufacturing:</i>	Metals, nonferrous and their products.
<i>Net Worth Class:</i>	\$100,000-\$250,000.
<i>Distribution:</i>	Principally local industry and river craft.
<i>Territory:</i>	Throughout the tri-state area.
<i>Seasons:</i>	Comparatively steady throughout the year.
<i>Conditions Surrounding Origin:</i>	

A meager amount of information is available. The concern was the second brass foundry established in Allegheny County.

Factors Contributing to the Longevity of any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, power, and labor.
2. Heavy demand for marine craft equipment, 1840–1880; steam and electrical pumps, 1880–1920; and wood working machinery during 1930's.

Longevity Factors Specifically Associated with Tranter Manufacturing Company:

1. Early entrance into brass foundry business.
2. Control over source of raw materials. (Operated own brass foundry several years after production had turned to marine equipment.)
3. Managerial guidance furnished by J. B. Sheriff, 1836–1892, and Henry Tranter, 1891–1940.
4. Inventive ability of W. J. Sheriff and the market control resulting from his numerous patents between 1869–1890.
5. Employment of capable administrator to augment the guidance furnished by the controlling interest.
6. Advantage resulting from an established reputation.
7. Ability of the firm to transfer from products undergoing a decreasing demand to products subsequently experiencing an expanding demand.
8. The company was incorporated in 1891 when Henry Tranter and N. C. Davidson operated the same until 1901, when N. C. Davidson withdrew and George H. Culley became interested in the company and took over the management of the mechanical department. They surrounded themselves with loyal employees who became interested in the company and upon their retirement continued the operation of the company in connection with a son of Henry Tranter.

Solutions of Conditions Severely Testing Survival Ability:

In the early 1890's, the business was suffering from inadequate supervision since J. B. Sheriff had virtually retired from active participation in the business. Henry Tranter and J. Davidson were placed in charge of financial administration and plant productivity, respec-

tively, and were provided an interest in the business. This action enabled the firm to regain a successful operating status.

The difficult period, 1931–1933, was terminated when WPA funds became available to purchase large quantities of wood and iron-working machinery for classroom instruction. Since this concern had started developing machinery for the school market in 1916, it was one of the few companies prepared to meet WPA's specifications.

APPENDIX U-21

<i>Name of Firm:</i>	William G. Johnston Company, Inc.
<i>Address:</i>	1130 Ridge Avenue, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Secretary, Sales Manager, and Supervisors of County and School Departments.
<i>Sequence of Trade Styles:</i>	1818, Eichbaum and Johnston. 1824, Johnston & Stockton. 1845, Samuel R. Johnston & Son. 1857, William G. Johnston & Co. 1915, William G. Johnston Co., Inc.
<i>Products:</i>	Printing, lithographing, engraving, and supplies for municipalities and schools.
<i>Division of Manufacturing:</i>	Printing and allied industry.
<i>Net Worth Class:</i>	\$250,000-\$500,000.
<i>Distribution:</i>	Sales are to various industrial concerns, municipalities, and public schools.
<i>Territory:</i>	Throughout Western Pennsylvania, Eastern Ohio, and Northern West Virginia.
<i>Seasons:</i>	Relatively stable throughout the year.
<i>Continuity of Control Established:</i>	1818.

Conditions Surrounding Origin:

In 1818 Mr. Samuel Johnston and William Eichbaum, brothers-in-law, became partners and sole owners of the pioneer printing business in Pittsburgh established by Zadok Cramer in 1800. Mr. Eichbaum had served an apprenticeship of seven years in the firm of Cramer & Spear. He married Samuel Johnston's sister and influenced Johnston to provide the capital required to purchase the business in which he had been interested.

Factors Contributing to the Longevity of any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, power, and labor.
2. Products have experienced a relatively steady demand which has gradually expanded with a minimum of style change.

Longevity Factors Specifically Associated with William G. Johnston Company, Inc.:

1. Original establishment of its kind in Allegheny County.
2. Previous experience of its founders.
3. Control of raw material source with erection of a paper mill at Fallston, Pa. in 1825.
4. Installation of first power printing press west of the Allegheny Mountains.
5. Managerial guidance furnished by Samuel R. Johnston, 1818-1845; William G. Johnston, 1857-1890; H. P. Pears, 1880-1915.
6. Birth of children, within the family, willing and capable of successfully continuing the business.
7. W. G. Johnston's daughter, Mrs. H. P. Pears, deciding, upon the retirement of her husband, to sell her capital stock to the employees of the company.
8. The advantage resulting from an established reputation.
9. Excellent financial connections during first seventy-five years of existence.
10. Favorable political position of the Johnston & Eichbaum families during the infancy of the business. (Postmastership of Pittsburgh for twenty-nine years.)
11. Excellent employee relations. Approximately 10 per cent of the employees have over forty years of service; 25 per cent over twenty years; and one of three over ten.
12. Advantages resulting from several patents.
13. Original introduction of numerous printing and publishing innovations to the Allegheny County area.
14. Development of an important part of the business from the rapid action taken following the enactment of Pennsylvania's free textbook law in 1892.
15. Extensive development of municipality, county, and election business tending to stabilize operation.
16. Operating policy dominated by a conservative Scotch-Presbyterian influence.
17. Emphasis placed on offering a superior service.
18. Emphasis placed on offering a superior product.

Solution of Conditions Severely Testing Survival Ability:

Shortly before 1930, the company borrowed heavily to finance the purchase of the capital stock of several old stockholders. Sales fell off during the early depression years and amortization requirements on the bank loan contributed toward operating losses being sustained. A sizable trade debt accumulated, but at a meeting of creditors in December, 1935, the company's proposal to settle immediately all claims under \$50 and receive an extension of all claims exceeding \$50 was accepted. Subsequently, all creditors were paid in full and a favorable working capital position was restored.

APPENDIX U-22

<i>Name of Firm:</i>	Bunting Stamp Company (Inc.).
<i>Address:</i>	312 Boulevard of the Allies, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President, Secretary and Treasurer.
<i>Sequence of</i>	1871, W. A. Bunting.
<i>Trade Styles:</i>	1899, W. A. Bunting & Son. 1902, Weber-Erickson-Bunting Co. 1917, Bunting Stamp Company (Inc.).
<i>Products:</i>	Rubber stamps, marking and tagging devices. Also badges, pennants, signs and seal marking devices.
<i>Division of</i>	
<i>Manufacturing:</i>	Printing and allied industries.
<i>Net Worth Class:*</i>	\$25,000-\$50,000.
<i>Distribution:</i>	Principally to industrials. Also to wholesalers and retailers.
<i>Territory:</i>	Eastern part of the United States.
<i>Seasons:</i>	Steady throughout the year.
<i>Continuity of Control</i>	
<i>Established:</i>	1871.

Conditions Surrounding Origin:

Pittsburgh had one stencil, stamp and marking device manufacturing concern in 1869. J. F. W. Dornion & Co., a Baltimore firm, had been selling stencils and stamps to local enterprises. Their business expanded, and in 1869 they opened a branch establishment in Pittsburgh under the guidance of W. A. Bunting who was formerly connected with the Baltimore office. Bunting, convinced of the opportunities this area presented, arranged to acquire control of the branch establishment in 1871 and changed the trade style to W. A. Bunting.

* Replacement cost or sound value of working assets substantially exceeds their carrying value in net worth calculation.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor, particularly during the first fifty years of the firm's existence.
2. Demand has expanded.

Longevity Factors Specifically Associated with Bunting Stamp Company (Inc.):

1. Second manufacturing firm of its type established in the Allegheny County area.
2. Timeliness of entrance into its manufacturing field.
3. Previous experience of founder.
4. Managerial guidance furnished by W. A. Bunting, 1871-1899; Charles H. Bunting, Sr., 1900-1931.
5. Birth of children within the family willing and capable of successfully continuing the business.
6. Advantage resulting from an established reputation.
7. Market control resulting from patents.
8. Intentional training of family members to succeed to managerial positions in the business.
9. Employment of capable administrators to augment the guidance furnished by controlling interest.
10. Favorable labor relations.
11. Product agreement which, with other firms, controlled the output of a mutually operated subsidiary producing a patented line dater.
12. Immediate installation of improved machinery.
13. Emphasis placed on service to customer.
14. Highly conservative operating policy.

Solution of Conditions Severely Testing Survival Ability:

Price cutting competition was adversely affecting the industry in the early 1900's. Charles H. Bunting initiated arrangements to merge three of the competing concerns into one enterprise under his control. Stability was thereby returned to the industry. Charles H. Bunting died while the country was entering the great depression. Thus, the company received a double blow toward its continued existence. Survival resulted from extensive retrenchment of operations by the controlling interest.

APPENDIX U-23

<i>Name of Firm:</i>	Jas. H. Matthews & Co., Inc.
<i>Address:</i>	3942-46 Forbes Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Secretary and Treasurer.
<i>Sequence of</i>	1850, John D. Matthews.
<i>Trade Styles:</i>	1888, Matthews and Zinn.
	1893, Jas. H. Matthews & Co.
	1902, Jas. H. Matthews & Co., Inc.
<i>Products:</i>	A complete line of rubber and brass printing dies, steel marking dies, brass stencils, sales checks, bronze memorial tablets, and marking machines.
<i>Division of</i> <i>Manufacturing:</i>	Printing and allied industries.
<i>Net Worth Class:</i>	\$1,000,000-\$5,000,000.
<i>Distribution:</i>	Sales are to industrials, wholesalers, municipalities, cemeteries, and utilities.
<i>Territory:</i>	Throughout United States, Canada, and some other foreign countries.
<i>Seasons:</i>	Comparatively steady throughout the year.
<i>Continuity of Control</i> <i>Established:</i>	1850 was the earliest date which could be substantiated by historical records. Company has some evidence that 1849 was date of origin.

Conditions Surrounding Origin:

John Dixon Matthews, a skilled craftsman from Sheffield, England, arrived in Pittsburgh to find a complete absence of stencil and stamp manufacturers in operation. He thought that local industry would support such an enterprise, and having the necessary experience and capital, he established himself as a stencil and stamp maker.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor. Location not particularly advantageous during past twenty-five years.
2. Products have experienced an expanding demand without encountering wide style changes.

Longevity Factors Specifically Associated with Jas. H. Matthews & Co., Inc.:

1. Original manufacturer of its kind in Allegheny County.
2. Previous experience of the founder.
3. Managerial guidance furnished by John D. Matthews, 1850-1877; James H. Matthews and William Jenkins 1893-1941.
4. Excellent combination of abilities provided by Mr. Matthews in production and Mr. Jenkins in sales and finance.
5. Sincere interest and action taken by Mr. Matthews and Mr. Jenkins to perpetuate the business for the employees.
6. Having capable successors for management.
7. Advantage resulting from an established reputation.
8. Excellent labor relations.
9. The company's constant attempt to render a superior service to its customers.

The Solutions of Conditions Severely Testing Survival Ability:

John D. Matthews intentionally trained his sons to take over the management of the business; but he recognized their limited administrative ability, and prior to his death, in 1877, he provided for a man in whom he had great confidence to replace him as business manager while his sons would supervise production. His trust was misplaced, and by 1892, the firm was in a very unfavorable condition.

William Jenkins, formerly Secretary-Treasurer of the Oliver Iron & Steel Co., became associated with Matthews in 1893. This proved to be a wise move, as under Mr. Jenkins' capable leadership and guidance the company rapidly returned to a favorable position.

APPENDIX U-24

<i>Name of Firm:</i>	Harbison-Walker Refractories Co. (Inc.).
<i>Address:</i>	301 Fifth Avenue, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Assistant to the President.
<i>Sequence of</i>	1865, Star Fire Brick Company.
<i>Trade Styles:</i>	1874, Reed and Harbison, a partnership. 1875, Harbison & Walker, a partnership composed of Samuel P. Harbison and Hay Walker. 1894, Harbison and Walker, a corporation of Pennsylvania. 1901, Harbison-Walker Company, a corporation of Pennsylvania. 1902, Harbison-Walker Refractories Company, a corporation of Pennsylvania.
<i>Products:</i>	Fire brick and other refractory materials.
<i>Division of</i>	
<i>Manufacturing:</i>	Stone, clay, and glass.
<i>Net Worth Class:</i>	\$25,000,000 and over.
<i>Distribution:</i>	Large number of iron and steel manufacturers, foundries, manufacturers of glass, chemicals, and coke.
<i>Territory:</i>	Throughout the United States, in Canada, and abroad.
<i>Seasons:</i>	Comparatively steady throughout the year.
<i>Continuity of Control</i>	
<i>Established:</i>	1865.

Conditions Surrounding Origin:

Mr. J. H. Lemon secured six individuals, including Joseph Myers, as stockholders in the organization of the Star Fire Brick Co. with a capital of \$8,000. The new enterprise was organized to manufacture fire brick to meet the unusual replacement demand for furnace linings which had been worn out by the unprecedented operations resulting from the Civil War. S. P. Harbison, bookkeeper for Joseph Myers and a former school teacher, was engaged to open up the company's books. He purchased a one-sixteenth interest in the business in the spring of 1866.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, power, transportation, and labor.
2. Products have experienced an expanding demand.

Longevity Factors Specifically Associated with Harbison-Walker:

1. Timeliness of entrance into the refractory industry.
2. Favorable financial connections throughout early years of existence, especially by Hay Walker.
3. Managerial guidance furnished by S. P. Harbison, Hepburn Walker, and Samuel C. Walker.
4. S. P. Harbison's boyhood friendship with Andrew Carnegie and Mr. Henry Phipps, Jr., and John Walker.
5. Employment of capable administrators to augment the guidance of the controlling interest.
6. Advantage resulting from an established reputation.
7. Securing the linings for the Lucy Furnace and other furnaces of the Carnegie Steel Company Limited, and receiving testimonial letters from Thomas M. Carnegie, H. M. Curry, William Jones, and others testifying to the production records broken by these furnaces on account of the superiority of the linings sold, led to the company's securing practically all the blast furnace lining markets from the middle '70's on.
8. Constant search for a superior clay, free from iron ore, was rewarded by the discovery of major deposits in Clarion County.
9. Successful operating policy resulting from a conservative Scotch-Presbyterian influence.
10. Extensive research and experimenting contributing heavily to the production of a superior product.
11. The vast resources represented by the best deposits of clay, coal, silica rock, magnesite, and chrome.

Solution of Conditions Severely Testing Survival Ability:

The company borrowed heavily for expansion purposes in 1874 on accommodation notes from Allegheny Trust Company. The financing was arranged by W. A. Reed, a partner in the firm, who was also president of the lending institution. The bank's failure placed the company in a precarious financial position. Mr. Hay Walker's purchase of Mr. Reed's interest brought new capital.

APPENDIX U-25

<i>Name of Firm:</i>	E. M. Hill Lumber Co.
<i>Address:</i>	2601 Penn Avenue, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	General Partner.
<i>Sequence of</i>	1848, James B. Hill.
<i>Trade Styles:</i>	1867, James B. Hill & Co. 1904, Edwin M. Hill Lumber Co.
<i>Products:</i>	Complete line of lumber, including white and yellow pine, hemlock, heavy timbers, and hardware. Also, wholesale wall and insulation board.
<i>Division of</i>	
<i>Manufacturing:</i>	Lumber and its products.
<i>Net Worth Class:</i>	\$500,000-\$1,000,000.
<i>Distribution:</i>	Normally, 60 per cent of sales to industrial concerns and the remaining 40 per cent to yards and building contractors.
<i>Seasons:</i>	Subject to seasonal variation.
<i>Territory:</i>	Sales are confined principally to the Pittsburgh district.
<i>Continuity of Control</i>	
<i>Established:</i>	1848.

Conditions Surrounding Origin:

James B. Hill, an Irish immigrant, arrived in the United States in 1830. He learned the carpentry trade in Ireland, and with his brother, Robert Hill, followed his trade in Pittsburgh between 1830 and 1848. He accumulated a small amount of capital and established a lumber mill in 1848 to help supply Pittsburgh's growing building activity.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor.
2. Product, although highly susceptible to business depressions, has experienced a long term growing demand.

Longevity Factors Specifically Associated with E. M. Hill Lumber Company:

1. Early entrance into lumber industry in its area.
2. Previous experience of the founder.
3. Managerial guidance furnished by James B. Hill, 1848-1901; Edwin M. Hill, 1901-1929; E. Bruce Hill, 1929-1947.
4. Advantage resulting from an established reputation.
5. Birth of children within the family willing and capable of successfully continuing the business.
6. Control exercised over raw material sources.
7. Acquirement of heavy government contracts for shell cases, during the Civil War, contributing substantially to expansion of facilities.
8. Pioneer firm, in its area, in introducing several innovations, especially machinery for tongue and groove flooring.
9. Favorable labor history.
10. The combatting of seasonal demand by producing stock items during winter and handling special items and current orders in the summer.
11. Emphasis placed on superior service.
12. Maintaining honesty and fair dealing in an industry highly susceptible to unfair practices.
13. Production of a quality product.
14. Acceptance of difficult production jobs establishing a reputation for handling the tough, special, unusual, and seemingly impossible construction problems.

Conditions Severely Testing Survival Ability and Their Solutions:

Although never in serious trouble, the company weathered the great depression by reducing number of employees and wage scales and increasing sales effort. Losses were replaced by funds provided by the controlling interest.

APPENDIX U-26

<i>Name of Firm:</i>	Mayer Body Corporation.
<i>Address:</i>	202-210 Auburn St., Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President, General Manager.
<i>Sequence of</i>	1868, Fred Mayer.
<i>Trade Styles:</i>	1904, Mayer Bros. 1913, Mayer Wagon Co., Inc. 1922, Mayer Body Corp.
<i>Products:</i>	1868 to 1915, carriages, coaches and wagons; 1904 to 1947, auto truck bodies and body equipment.
<i>Division of</i>	
<i>Manufacturing:</i>	Wood and its products.
<i>Net Worth Class:</i>	\$250,000-\$500,000.
<i>Distribution:</i>	To manufacturers of auto trucks, hauling contractors, commercial enterprises, and various industrial concerns.
<i>Territory:</i>	Throughout western Pennsylvania, eastern Ohio, northern West Virginia, and the tri-state area.
<i>Seasons:</i>	Fairly steady throughout the year.
<i>Continuity of Control</i>	
<i>Established:</i>	1868.

Conditions Surrounding Origin:

Fred Mayer, proprietor of a coach building establishment which had been operated by his father and grandfather in Baden, Germany, came to the United States in 1865. After working at his trade in various American cities, he arrived in Pittsburgh, where he found a demand for a carriage, coach, and wagon manufacturing business. Since he was an experienced coach builder in possession of the necessary capital, he established a small enterprise in 1868.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, power, transportation, and labor.

2. When the expanding demand for the original product began to subside, it was replaced with an improved product which attracted an even greater demand.

Longevity Factors Specifically Associated with Mayer Body Corporation:

1. Previous experience of the founder.
2. Managerial guidance furnished by Fred Mayer, 1868–1885; Fred Mayer, Jr., 1886–1945.
3. Birth of children within the family willing and capable of successfully continuing the business.
4. Advantage resulting from an established reputation.
5. Early conversion of manufacturing emphasis from coach and wagons to auto truck bodies.
6. Control of raw materials obtained by operating own lumber mill and wood-working shop.
7. Extremely conservative policy of expanding only on company accumulated cash.
8. The intentional training of members of the firm to become administrators in the business.
9. The policy of operating all stages of production from original design to completed product.
10. Frequent introduction of innovations, many protected by patents, to the industry.
11. Utilizing standard dies, capable of adaptation to special jobs, in the productive process.
12. The building of specially designed wagons, coaches, and truck bodies which vary slightly from standard equipment insuring the securing of replacement and maintenance on equipment sold.
13. Emphasis placed on quality product.
14. Limiting operation to the size which can be adequately supervised by officials of the family.
15. Maintaining adequate insurance protection against fire losses.
16. Favorable labor relations.

Conditions Severely Testing Survival Ability and Their Solutions:

With the exception of 1938 and 1939, when operating losses were sustained, the business has enjoyed profitable operation since inception. Conditions have never existed which have severely tested survival ability.

APPENDIX U-27

<i>Name of Firm:</i>	The Schnabel Company (Inc.).
<i>Address:</i>	1000-1021 Muriel Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President, Chairman of the Board, Treasurer.
<i>Sequence of</i>	1860, Martin Schnabel.
<i>Trade Styles:</i>	1873, Gustave Schnabel. 1895, G. A. Schnabel Sons Company. 1923, The Schnabel Company (Inc.).
<i>Products:</i>	1860-1920, wagons, coaches, and carriages; 1913- 1947, general line of motor truck bodies.
<i>Division of</i>	
<i>Manufacturing:</i>	Iron and steel and their products.
<i>Net Worth Class:</i>	\$250,000-\$500,000.
<i>Distribution:</i>	Before 1915 volume was with drayage concerns, department stores, industrials, and individuals. Subsequent to 1915, volume has transferred to motor truck dealers, public utilities, and fleet operations.
<i>Territory:</i>	1860-1915, primarily of a local nature. Subse- quent to 1915, territory expanded to tri-state area with ice cream and milk truck bodies dis- tributed nationally.
<i>Seasons:</i>	Originally volume was reduced during winter months. In recent years volume has been steady throughout the year.
<i>Continuity of Control</i>	
<i>Established:</i>	1860.
<i>Conditions Surrounding Origin:</i>	

Martin Schnabel was born in Austria, where he participated in the wagon and carriage making establishment which had been operated by his family for many years. In order to avoid compulsory military service, he came to the United States and joined his uncle in Pittsburgh. Possessing some capital and superior coach and carriage making ability, he established, in 1860, a manufacturing enterprise which catered to the heavy local demand for quality horse-drawn vehicles.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, power, and labor.
2. From 1860 to 1910 a steady demand existed for horsedrawn vehicles. The substitution of motor trucks for wagons created a constantly expanding demand for truck bodies.

Longevity Factors Specifically Associated with The Schnabel Company:

1. Previous experience of the founder.
2. General managerial guidance furnished by Martin Schnabel and Gustave Schnabel.
3. Adequate financing during formative period.
4. Advantages resulting from an established reputation.
5. Birth of children within the controlling family willing and capable of successfully continuing the business.
6. Intentional training of the controlling family's children to occupy executive positions.
7. Emphasis placed on superior quality of product.
8. Timely entrance into the wagon and coach business. The concern originated just before the outbreak of the Civil War. Government contracts were secured for the production of wagons, and the firm was securely established when the war ended.
9. Rapid adoption of new machinery and production methods.
10. Introduction of several new products to the Allegheny Co. area.
11. Substituting the production of auto truck bodies for carriage and coach-making activities.
12. Availability of financing during a critical period.
13. Conservative operating policy. Heavy reinvestment of profits.
14. Addition in 1940 of metal fabrication which is now a big department with the company.

Solution of Conditions Severely Testing Survival Ability:

1. A disastrous fire destroyed almost the entire plant in 1911. Very little insurance protection was being maintained.
2. A combination of fraud and the prevailing business level placed the company in a precarious condition in the early 1930's. A reorganization of personnel within the financing department and the procurement of extensive W.P.A. contracts for truck bodies enabled the concern to return to a favorable position.

APPENDIX U-28

<i>Name of Firm:</i>	A. F. Schwerd Manufacturing Co.
<i>Address:</i>	3181-3215 McClure Ave., Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President, Treasurer.
<i>Sequence of</i>	1860, A. F. Schwerd.
<i>Trade Styles:</i>	1879, A. F. Schwerd & Son. 1911, A. F. Schwerd Manufacturing Co.
<i>Products:</i>	Detail wooden porch columns and other special wood turnings.
<i>Division of</i>	
<i>Manufacturing:</i>	Lumber and its products.
<i>Net Worth Class:*</i>	\$10,000-\$25,000.
<i>Distribution:</i>	Sales are to planing mills and retail lumber concerns.
<i>Territory:</i>	United States.
<i>Seasons:</i>	Volume reaches a peak from March through November.
<i>Continuity of Control</i>	
<i>Established:</i>	1860.

Conditions Surrounding Origin:

A. F. Schwerd, a German immigrant, learned wood detail work while working in his family's business in Germany. After entering the United States, he engaged in contracting and building in Pittsburgh. His business expanded to the point that it appeared profitable to operate his own mill to supply original and replacement columns and wood work, so, in 1860 he established his own mill. The superiority of his product attracted the attention of other contractors. Outside orders increased until it became profitable to terminate his contracting business and devote his entire attention to operating the mill.

* Replacement cost or sound value of working assets substantially exceeds their carrying value in net worth calculation.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, raw materials, transportation, power, and labor. (Location has not been advantageous during the past forty years.)
2. Product experienced an expanding demand for about forty years after the company was established.

Longevity Factors Specifically Associated with A. F. Schwerd:

1. Previous experience of the founder.
2. Managerial guidance furnished by A. F. Schwerd, 1860–1900; A. H. Schwerd, 1900–1932; C. E. McKenry, 1932.
3. Superiority of product during early years of the business and continuing today.
4. Birth of children within the Schwerd and McKenry families, capable and willing to successfully continue the business.
5. Advantage resulting from an established reputation.
6. Favorable financial connections for many years.
7. Concentrating on a quality product designed for special purposes instead of competing with cheaper stock items.
8. Diverting sales effort to localities where product demand has continued.
9. Patents on various staves and machinery providing temporary advantages.
10. Obtaining contracts for interior work of large ships during the First World War and “dummy shells” during the Second World War.

Solution of Conditions Severely Testing Survival Ability:

1. When wood columns lost their popularity in the Pittsburgh area, the company's sales were almost completely limited to replacement orders. The firm was approaching termination when a decision to introduce their product to the entire United States resulted in a broader market.
2. By 1942, the firm was again in a serious financial condition. War contracts expanded normal volume by about 25 per cent and enabled the firm to enjoy more favorable operations.

APPENDIX U-29

<i>Name of Firm:</i>	A. Mamaux & Son.
<i>Address:</i>	120-22 Blvd. of the Allies, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	Comptroller, Office Manager, and General Partner.
<i>Sequence of Trade Styles:</i>	1865, E. Mamaux & Son. 1874, Mamaux & Son. 1927, A. Mamaux & Son, Inc. 1942, A. Mamaux & Son.
<i>Products:</i>	Awnings, tarpaulins, waterproof covers, vene- tian blinds and canvas products.
<i>Division of Manufacturing:</i>	Not elsewhere classified (Textiles).
<i>Net Worth Class:</i>	\$250,000-\$500,000.
<i>Distribution:</i>	Department and chain stores and directly to consumer.
<i>Territory:</i>	Tri-state area.
<i>Seasons:</i>	Peak periods reached during April, May, and June.
<i>Continuity of Control Established:</i>	1865.

Conditions Surrounding Origin:

The great demand for canvas coverings for horses being used in the Civil War caused Albert Mamaux and his father, French immigrants skilled in sail and awning making, to establish a canvas covering business in Pittsburgh in 1865.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Proximity to raw materials, sales market, transportation, power, and labor. Also, isolation from strong competition during early years.
2. Steady demand for canvas materials of one type or another.

Longevity Factors Specifically Associated with A. Mamaux & Son:

1. Timely origin.
2. Previous experience of founder.
3. Managerial guidance furnished by A. L. Mamaux, 1865–1912, and John Mamaux, 1915–1942.
4. The craftsmanship of E. Mamaux and his son enabling the business to offer, for many years, a product superior to competitive goods.
5. The birth of children within the family willing and capable of successfully continuing the business.
6. Extreme seasonal variations offset, during the early operation of the business, by peddling oysters.
7. The company's traditional emphasis on supplying customers with superior service.
8. Frugality of owners providing finances for operation and expansion.
9. Advantage resulting from an established reputation.
10. Desire to perpetuate business by training the children of the owners. Also provisions in the wills of Albert and John Mamaux stated that if their heirs preceded them in death, the business would be transferred to the employees and operated under the old trade style.
11. Maintaining insurance protection against fire losses.

Solution of Conditions Severely Testing Survival Ability:

No critical periods were discovered. The carrying of insurance protection avoided the absorption of considerable loss from fire damage in 1924, 1929, and 1945.

APPENDIX U-30

<i>Name of Firm:</i>	Wolfe Brush Company.
<i>Address:</i>	Pennsylvania Avenue and Bidwell Street, Pittsburgh, Pennsylvania.
<i>Officials Interviewed:</i>	President, Executive Vice-President, and Secretary-Treasurer.
<i>Sequence of Trade Styles:</i>	1851, David Stewart. 1869, Stewart & Co. 1883, Wolfe, Patton & Co. 1886, Wolfe Bros. & Co. 1898, Wolfe, Walker & Co. 1912, Wolfe Brush Co.
<i>Products:</i>	Industrial brushes for painting and cleaning purposes.
<i>Division of Manufacturing:</i>	Not elsewhere classified (Brushes).
<i>Net Worth Class:</i>	\$250,000—\$500,000.
<i>Distribution:</i>	Volume is entirely with railroads and industrial concerns.
<i>Territory:</i>	Entire United States.
<i>Seasons:</i>	Business is steady throughout the year.
<i>Continuity of Control Established:</i>	1851.

Conditions Surrounding Origin:

Only information obtainable was that four brush manufacturers were operating in Pittsburgh when this company originated. However, they manufactured brushes for every purpose; this company concentrated on industrial brushes.

Factors Contributing to the Longevity of Any Concern Operating under Similar Conditions:

1. Location provided proximity to sales market, transportation, power, and labor.
2. Product has experienced an expanding demand.

Longevity Factors Specifically Associated with Wolfe Brush Co.:

1. Early entrance into its particular field.
2. Managerial guidance furnished by David Stewart, 1851–1883; C. E. Wheelock, Sr., 1910–1947.
3. Advantages resulting from an established reputation.
4. Employment of capable administrators to augment the guidance furnished by the controlling interest.
5. Excellent marketing methods.
6. Excellent employee relations.
7. Offering of superior service.
8. Marketing of a superior product.
9. Specializing in a specific segment of the industry.
10. Conservative operation.
11. Prudent financial policy emphasizing extensive reinvestment of profits.

Solution of Conditions Severely Testing Survival Ability:

No critical periods could be discovered.

APPENDIX V

HOW THIS STUDY WAS MADE

A rough survey completed recently by the Allegheny Conference of Community Development indicates that Allegheny County has twelve manufacturing concerns which have existed over one hundred years, thirty over seventy-five years, ninety-six over fifty years, and approximately three hundred over twenty-five years.¹ Why have these particular firms lived beyond the term of years which previous studies show exceeds the average life expectancy of manufacturing concerns?

SELECTION

The determining of some of the factors which contributed to the unusual longevity of specific manufacturers located in Allegheny County is one of the reasons for this study.

But to select firms which would reflect a representative sample was not easy. The eventual selection of that group of firms which had lived seventy-five years or more was largely arbitrary.

Of course, an adequate investigation of three hundred firms would have been beyond the scope of this study. The same is true of the ninety-six firms with a life span exceeding fifty years. Limiting the present study to the twelve which have lived one hundred years or more would have necessitated the use of dates of entry prior to 1848, which was eight years before the first Allegheny directory was published on an annual basis. Then, too, the use of only twelve firms appeared to be an inadequate sampling for valid conclusions.

Investigation shows that the thirty manufacturing enterprises which have lived at least seventy-five years have exceeded normal life expectancy.

Before accepting for this study a concern as one which has experienced an unusual length of life, its age was compared with the average age reached by enterprises in Allegheny County which belong to the same division of manufacturing and which have had an equal opportunity of surviving at least seventy-five years. A firm might have longevity which greatly exceeded the average of all manufacturing concerns, and yet, its age actually be below the average age reached by firms in its particular division of manufacturing. For example, it appears

¹ These facts appeared during a survey or industrial inventory of Allegheny, Beaver, Washington, and Westmoreland County conducted by the Allegheny Conference of Community Development.

in the Minneapolis, St. Paul, and Duluth study ² that a printing establishment which was forty-two years old had a life span exceeding by thirty-four years the average length of life of other manufacturing concerns included in the study. But, it had lived 20.6 years less than the average printing establishment in the area. Certainly, factors contributing to the survival of such a concern could not validly represent factors contributing to above average length of life for all other manufacturing firms. Consequently, we found it necessary to determine the average length of life of manufacturing groups located in Allegheny County prior to 1874 (at least seventy-five years old) before a manufacturing concern surviving the period 1873 to 1947 could be designated as having had above average longevity.

The major sources for this part of the study were the annual business directories of Pittsburgh and Allegheny, which were compiled and published by George H. Thurston from 1856 through 1873; compiled by Thurston and J. F. Diffenbacher from 1874 through 1877 and published by A. A. Anderson & Sons, compiled by Diffenbacher from 1878 through 1895 and published by Stevenson & Foster, W. W. Lewis & Company, and James Eichbaum and Company; compiled and published by R. L. Polk and Company, Detroit, from 1896 through 1947.

The procedures employed by Thurston, and later by Thurston and Diffenbacher, could not be ascertained definitely; however, they probably followed closely the methods of R. L. Polk and Company, which has representatives make a house-to-house, business-to-business canvass of all the addresses in the city and its immediate vicinity, usually during May, June, and July of each year. After being closely checked, the data are arranged alphabetically and according to the types of business and are published in the annual directory in December. The classified lists of manufacturers as given in these directories are the only available records of manufacturing concerns in Allegheny County over an extended period of time. Although such data cannot be absolutely accurate and complete, comparison with data issued by other agencies indicates that the listings are substantially correct.

PROCEDURE

The procedure followed in this study in computing a manufacturing concern's length of life may be described as follows:

The year 1856 was selected as the initial year of the investigation because that was the first year the Pittsburgh and Allegheny directory was published on an annual basis. Although directories were published

² Heilman, E. A., *op. cit.*, page 12.

prior to 1856, they appeared irregularly and did not contain the names of firms which originated and died during the intervening periods in which directories were not published.

The name, address, and type of manufacture of each of the manufacturing concerns listed in the Pittsburgh and Allegheny directory for the year of 1856³ were recorded separately on three by five inch cards. Each succeeding year in which a concern was listed at the same address was marked on the card. If a concern was not listed, the year, of course, was not noted on the card. When a firm not mentioned in a previous year appeared, a card was made for that firm. If there was a change in the firm style or the address, a new card was made out. After the classified section of each directory had been covered, those firms for which the year had not been recorded were traced in the alphabetical section of the directory. This procedure located a few firms which otherwise would have been classified as dead.⁴

When the period 1856-1873 had been covered in this manner, the cards were arranged in alphabetical order according to firm names. The cards were then reviewed to group those cards which showed the same name. When two bearing the same firm style and the same type of manufacturing were discovered at two different addresses, with the older card not having the same date as that identifying the year of birth on the newer card, the two or more cards were assumed to represent the same business and were consolidated as a continuation of the old business at a new address. In most cases it was possible to get verification of this action from historical publications.⁵ When two or more cards bearing similar names, identical businesses, and different addresses were discovered, they were tabulated as two separate companies, unless historical references were found to confirm a continuity of the firm with a change in the trade style and address.

The cards were then rearranged according to street address, and those changes due obviously to typographical errors and misspelled names and addresses were corrected. When two or more cards for firms engaging in the same type of manufacture at the same address but showing a slight deviation in trade style were found⁶ they were combined as a

³ Thurston, George H., *Directory for 1856-57 of Pittsburgh and Allegheny Cities*, George H. Thurston, Pittsburgh (1856).

⁴ The early directories were not as reliable as those of later years.

⁵ See publications listed on pp 225, 226, Bibliography.

⁶ A slight deviation is here defined as the addition or deletion of Sr., Jr., Inc., Son and Brother, and Brothers, the interchange of given initials with given names commencing with the same initial and the interchange of middle initials with middle names commencing with the same initial.

continuation of the same business. If two or more cards were for firms engaging in the same type of manufacture at the same address but showing a decided deviation in trade style, they were counted as separate concerns unless information showing they were a continuation of the original firm with a major change in trade style could be found elsewhere. Although the above methods are subject to some error, the error has not been considered sufficient to invalidate the study.

The problem of definitions is most difficult to handle satisfactorily in this kind of study. For instance, what is a manufacturing concern? This problem was originally handled by simply taking the concerns as found in the classified lists in the directories. Since city directories are prepared for reference purposes, they often carry the same manufacturing concern under two or more classifications. To obviate this difficulty separate cards were prepared for manufacturers carried under two or more classifications. These separate cards were consolidated when the cards were arranged in alphabetical order according to names.

New concerns were not recorded after 1873. The manufacturers listed in the 1873 directory were traced through subsequent directories, using the same methods employed during the period 1856-1873. In addition to the data taken from directories, extensive use was made of books, newspaper items, periodicals, trade journals, and advertising brochures published throughout the period studied. Wherever it could be determined that a firm had continued the same trade style beyond the period of continuity of control, that firm's card was corrected to reflect termination of the concern with the year in which a severance of control was established.

In like manner, those enterprises which changed from manufacturing to jobbing, wholesaling, or retailing were removed from the active file. Firms, although living, were discontinued if they moved out of the county. Furthermore, the continuation of a manufacturing concern within Allegheny County, after it had become a division or subsidiary of a parent company located elsewhere, was not considered to justify its existence for further inclusion among the surviving concerns. In those instances in which a merger was completed among various firms, they were discontinued, unless one of the old firms could be established as the controlling interest in the new organization. Throughout the study, emphasis was placed on continuity of control of a manufacturing activity within Allegheny County. The absence of any of these three

general requirements would disqualify a business from further consideration.

In making this part of the study there was employed, to some extent, the terminology and methods of the insurance actuaries. This adoption does not imply that the data are considered entirely adequate for such purposes. In the first place, there is an insufficient number of concerns involved to produce valid actuarial conclusions. Secondly, new entrances of concerns were not tabulated after 1873, nor were entrances and exits prior to 1856 included, although firms surviving to 1856 were tabulated. In addition, no means were available to determine the age of a firm which withdrew from business before it had been operating for one year. Consequently, the study is limited to a year unit and does not make allowances for smaller units of time.

The method outlined above was employed so that at the end of the period the cards contained a life record of all the manufacturers which had been listed. The cards were then divided into manufacturing groups.⁷ From these manufacturing groups the data were assembled as given in the tables. The data for the various divisions of manufacturing were then combined to provide the tables for all manufacturers.

A problem arose regarding the age of the manufacturers listed in the 1856 directory. Their being listed in 1856 proved they were alive then, but it did not indicate how long they had been in existence. Such a firm could be one, five, twenty, or over fifty years of age in 1856. In order to provide valid lengths of life for those firms, it was necessary to determine their dates of birth. Recourse was made to *Pittsburgh as It Is*, a comprehensive review of Pittsburgh and Allegheny County's enterprises existing in 1856, by George H. Thurston.⁸ Thurston listed the date of origin of each concern, but that date was not acceptable unless the business had been founded by the proprietors operating it in 1856. Where a change in proprietors was recorded, the trade style, as listed in 1856, was traced back through the directories published prior to that year. Directories were published for the years 1854, 1852, 1850, 1847, 1844, 1841, 1839, 1837, 1826, 1819, 1817, and 1815. A firm was given credit for the earliest year it was listed in a directory. Obviously, this procedure was not accurate. A concern originating in 1833 would not be recorded until the 1837 directory was published. Although this procedure understated the life of all manufacturers not beginning in a year in which a directory was published, it provided a more accurate life span than could

⁷ See Appendix A.

⁸ Thurston, George H., *Pittsburgh As It Is*, W. S. Haven & Co., Pittsburgh (1857).

otherwise be obtained. Tables containing data from 1856 on were computed separately from those with data prior to that year.

1. *Interviews with Representatives of Manufacturing Concerns:*

After determining which manufacturing concerns originating before 1874 had survived the period under investigation, there remained unsolved the problem of determining the factors which contributed to their survival. It was decided that this information could be obtained most validly by reaching the surviving concerns.

The use of questionnaires seemed inadvisable. In the first place, widespread use of questionnaires makes them a generally abused method of collecting research data. Frequently they were answered inadequately or not at all. Secondly, the diversified nature of the eligible concerns eliminated the possibility of getting adequate information from standardized questions. Finally, it appeared that a personal interview with representatives of the eligible firms would create a more receptive attitude toward furnishing whatever additional information might subsequently be necessary to the successful completion of this study. Consequently, interviews appeared to offer the more advantageous method of contact.

An interview with just any member of a concern would not provide satisfactory answers. An individual long associated with a concern, and preferably in an administrative or official capacity, would be more likely to possess valid information. Also, individuals who were descendents of the controlling family would probably, because of family pride, possess much information concerning the early operation of the business. So, effort was concentrated on determining who in each concern would be the most desirable individual to interview.

Personal histories of the officers of each firm were compiled. These histories were compared to discover which officer appeared to have the greatest familiarity with the firm's operation over the longest period of time. The officer selected was then reached by phone.

The telephone conversation commenced with the caller's identifying himself. After explaining the nature of the investigation and the relation of the concern in question to the investigation, he requested an interview. Almost without exception there was a very co-operative and enthusiastic response.

An interview was arranged with a representative of each concern. Not all of the interviews were scheduled with the individual originally talked with. In a few instances, the person selected indicated that another indi-

vidual would be more capable of supplying the information desired. In other cases, the interview was held with the individual originally selected with additional members of the firm present. Frequently, the interviewer was permitted to question one or more employees who had a long record of service with the company.

The people interviewed held positions ranging from a skilled employee to a corporation president. An administrative officer, however, was interviewed at each concern. Occasionally, old employees were included in the interview or were introduced to the interviewer during a tour of the plant. Most of the persons interviewed were company presidents, although vice-presidents, treasurers, secretaries, comptrollers, plant supervisors, and assistants to the president often were included. One interview was conducted with three members of the board of directors of a corporation.

There was great fluctuation in the amount of information obtained from the various concerns. Some had maintained elaborate files on their development, and others had published extensive booklets celebrating an anniversary of some special event. Advertising brochures, reports to stockholders, company magazines, trade journals, newspaper clippings, company histories, books, copies of contracts, minutes of director's meetings, and even scrap books were provided by some firms. In a few cases the major part of the information was held in the memory of a representative of the firm. Whenever it was necessary to rely principally upon an individual's memory, difficulties usually developed. Either an individual's memory did not include early events or they were recalled so vaguely that their value was practically useless. One or two firms could not provide information regarding the first fifteen or twenty-five years of their existence. This resulted largely from the fact that control of the business, although possessing continuity, passed from one family to another.

Regardless of the information obtained throughout the interview, all interviews were closed with the same question. The company representative was asked to summarize what, in his opinion, were the outstanding factors contributing to the longevity of his concern. Usually, the answer would include the same points which had already been discussed. But, it served to bring them all together, and sometimes, to uncover a factor which had been ignored during the preceding discussion.

2. *Review of the Available Historical Records of the Manufacturers Listed in the Investigation.*

Besides the information obtained from the interviews, an extensive search for additional data was made in available historical documents. Practically all of these records were found in the Pennsylvania Room of the Carnegie Library and in the Library of the Pennsylvania Historical Society.

These records were studied for two specific reasons. First, it was necessary to get information otherwise unobtainable, since as previously pointed out, a few firms were largely unaware of their early histories. A thorough knowledge of what occurred during the past fifty years was necessary. But, probably more important to the total existence of the concern, were the events of the first twenty-five or fifty years. Secondly, verification of information previously accumulated was needed. There were several instances in which specific points of doubt could not be positively clarified by the interviews. Additionally, questionable conditions concerning continuity of control resulted from using the city directories. The recognition of the importance of these two for further study was vital to the success of the present investigation.

Numerous historical publications containing information concerning manufacturing concerns located in Allegheny County were used. Most of these publications were published between 1856 and 1905. It was this period which presented the greatest difficulty in determining continuity of control, and it included the time for which adequate information could not be obtained in the interviews. Most of the concerns, existing before 1856, were sufficiently proud of their history to have accumulated already the more salient facts of their development. Practically all of the firms had members who possessed a record of unbroken employment over the previous forty-five years. So, it was necessary to concentrate real effort on the period between 1856 and 1905.

The period of 1856–1890 was particularly important. Here, the investigation was extremely fortunate in having recourse to the statistical publications of George H. Thurston in 1856,⁹ 1876,¹⁰ 1886,¹¹ and 1888.¹²

⁹ Thurston, George H., *Pittsburgh As It Is*.

¹⁰ Thurston, George H., *Pittsburgh and Allegheny in the Centennial Year 1876*, A. A. Anderson & Co., Pittsburgh (1876).

¹¹ Thurston, George H., *Pittsburgh's Progress, Industries and Resources*, A. A. Anderson & Son, Pittsburgh (1886).

¹² Thurston, George H., *Allegheny County's Hundred Years*, A. A. Anderson & Son, Pittsburgh (1888).

Thurston, in each of these four volumes, recorded the origin, development, and the current condition of the various divisions of manufacturers located in Pittsburgh and its immediate vicinity. Within each manufacturing group, he listed the various manufacturing concerns, their trade style, location, date of establishment, name of founder, number of employees, plant capacity, production of specialties, and value of product. His contribution was invaluable in verifying questionable data and in providing data not otherwise obtainable. Although less important than Thurston, the contributions of Edwards,¹³ Leonard,¹⁴ Mills and Myers,¹⁵ and the Historical Publishing Company¹⁶ were exceedingly helpful.

¹³ Edwards, Richard, *Industries of Pittsburgh*, Richard Edwards & Company, Pittsburgh (1887).

¹⁴ Leonard, J. W., *Pittsburgh and Allegheny Illustrated Review*, J. M. Elstner & Co., Pittsburgh (1889).

¹⁵ Mills, James and Myers, E. A., *Pittsburgh: Its Industry and Commerce*, Barr & Myers, Pittsburgh (1870).

¹⁶ *Pennsylvania Historical Review*, Historical Publishing Company, Philadelphia (1886).

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